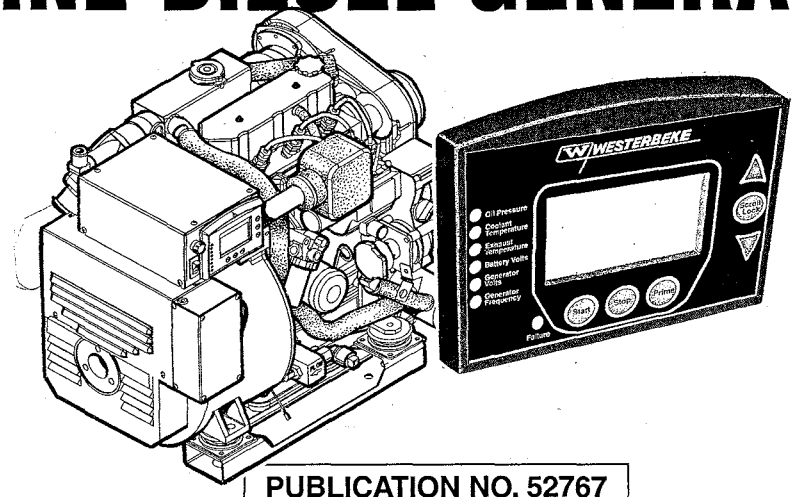
OPERATORS MANUAL

7.6KW ETD 60HZ

5.7KW ETD 50HZ

MARINE DIESEL GENERATORS



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WESTERBEKE

WESTERBEKE CORPORATION • 150 JOHN HANCOCK ROAD
MYLES STANDISH INDUSTRIAL PARK • TAUNTON MA 02780
WEBSITE: WWW.WESTERBEKE.COM

NMMA Member National Marine Manufacturers Association

CALIFORNIA
PROPOSITION 65 WARNING

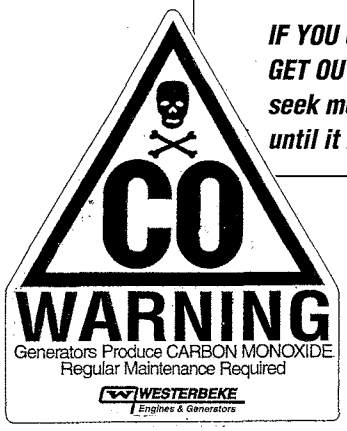
Marine diesel and gasoline engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

⚠ WARNING

Exhaust gasses contain Carbon Monoxide, an odorless and colorless gas. Carbon Monoxide is poisonous and can cause unconsciousness and death. Symptoms of Carbon Monoxide exposure can include:

- ***Dizziness***
- ***Nausea***
- ***Headache***
- ***Weakness and Sleepiness***
- ***Throbbing in Temples***
- ***Muscular Twitching***
- ***Vomiting***
- ***Inability to Think Coherently***

IF YOU OR ANYONE ELSE EXPERIENCE ANY OF THESE SYMPTOMS, GET OUT INTO THE FRESH AIR IMMEDIATELY. If symptoms persist, seek medical attention. Shut down the unit and do not restart until it has been inspected and repaired.



A WARNING DECAL is provided by WESTERBEKE and should be fixed to a bulkhead near your engine or generator.

WESTERBEKE also recommends installing CARBON MONOXIDE DETECTORS near the engine room. They are inexpensive and easily obtainable at your local hardware store.

WESTERBEKE
Engines & Generators

SAFETY INSTRUCTIONS

INTRODUCTION

Read this safety manual carefully. Most accidents are caused by failure to follow fundamental rules and precautions. Know when dangerous conditions exist and take the necessary precautions to protect yourself, your personnel, and your machinery.
The following safety instructions are in compliance with the American Boat and Yacht Council (ABYC) standards.

PREVENT ELECTRIC SHOCK

⚠ WARNING: ***Do not touch AC electrical connections while engine is running, or when connected to shore power. Lethal voltage is present at these connections!***

- Do not operate this machinery without electrical enclosures and covers in place.
- Shut off electrical power before accessing electrical equipment.
- Use insulated mats whenever working on electrical equipment.
- Make sure your clothing and skin are dry, not damp (particularly shoes) when handling electrical equipment.
- Remove wristwatch and all jewelry when working on electrical equipment.
- Do not connect utility shore power to vessels AC circuits, except through a ship-to-shore double throw transfer switch. Damage to vessels AC generator may result if this procedure is not followed.
- Electrical shock results from handling a charged capacitor. Discharge capacitor by shorting terminals together.

PREVENT BURNS — HOT ENGINE

⚠ WARNING: ***Do not touch hot engine parts or exhaust system components. A running engine gets very hot!***

- Always check the engine coolant level at the coolant recovery tank.

⚠ WARNING: ***Steam can cause injury or death!***

- In case of an engine overheat, allow the engine to cool before touching the engine or checking the coolant.

PREVENT BURNS — FIRE

⚠ WARNING: ***Fire can cause injury or death!***

- Prevent flash fires. Do not smoke or permit flames or sparks to occur near the carburetor, fuel line, filter, fuel pump, or other potential sources of spilled fuel or fuel vapors. Use a suitable container to catch all fuel when removing the fuel line, carburetor, or fuel filters.
- Do not operate with a Coast Guard Approved flame arrester removed. Backfire can cause severe injury or death.
- Do not operate with the air cleaner/silencer removed. Backfire can cause severe injury or death.
- Do not smoke or permit flames or sparks to occur near the fuel system. Keep the compartment and the engine/generator clean and free of debris to minimize the chances of fire. Wipe up all spilled fuel and engine oil.
- Be aware — diesel fuel will burn.

PREVENT BURNS — EXPLOSION

⚠ WARNING: ***Explosions from fuel vapors can cause injury or death!***

- Follow re-fueling safety instructions. Keep the vessels hatches closed when fueling. Open and ventilate cabin after fueling. Check below for fumes/vapor before running the blower. Run the blower for four minutes before starting your engine.
- All fuel vapors are highly explosive. Use extreme care when handling and storing fuels. Store fuel in a well-ventilated area away from spark-producing equipment and out of the reach of children.
- Do not fill the fuel tank(s) while the engine is running.
- Shut off the fuel service valve at the engine when servicing the fuel system. Take care in catching any fuel that might spill. DO NOT allow any smoking, open flames, or other sources of fire near the fuel system or engine when servicing. Ensure proper ventilation exists when servicing the fuel system.
- Do not alter or modify the fuel system.
- Be sure all fuel supplies have a positive shutoff valve.
- Be certain fuel line fittings are adequately tightened and free of leaks.
- Make sure a fire extinguisher is installed nearby and is properly maintained. Be familiar with its proper use. Extinguishers rated ABC by the NFPA are appropriate for all applications encountered in this environment.

SAFETY INSTRUCTIONS

ACCIDENTAL STARTING

⚠ WARNING: ***Accidental starting can cause injury or death!***

- Disconnect the battery cables before servicing the engine/generator. Remove the negative lead first and reconnect it last.
- Make certain all personnel are clear of the engine before starting.
- Make certain all covers, guards, and hatches are re-installed before starting the engine.

BATTERY EXPLOSION

⚠ WARNING: ***Battery explosion can cause injury or death!***

- Do not smoke or allow an open flame near the battery being serviced. Lead acid batteries emit hydrogen, a highly explosive gas, which can be ignited by electrical arcing or by lit tobacco products. Shut off all electrical equipment in the vicinity to prevent electrical arcing during servicing.
- Never connect the negative (–) battery cable to the positive (+) connection terminal of the starter solenoid. Do not test the battery condition by shorting the terminals together. Sparks could ignite battery gases or fuel vapors. Ventilate any compartment containing batteries to prevent accumulation of explosive gases. To avoid sparks, do not disturb the battery charger connections while the battery is being charged.
- Avoid contacting the terminals with tools, etc., to prevent burns or sparks that could cause an explosion. Remove wristwatch, rings, and any other jewelry before handling the battery.
- Always turn the battery charger off before disconnecting the battery connections. Remove the negative lead first and reconnect it last when disconnecting the battery.

BATTERY ACID

⚠ WARNING: ***Sulfuric acid in batteries can cause severe injury or death!***

- When servicing the battery or checking the electrolyte level, wear rubber gloves, a rubber apron, and eye protection. Batteries contain sulfuric acid which is destructive. If it comes in contact with your skin, wash it off at once with water. Acid may splash on the skin or into the eyes inadvertently when removing electrolyte caps.

TOXIC EXHAUST GASES

⚠ WARNING: ***Carbon monoxide (CO) is a deadly gas!***

- Ensure that the exhaust system is adequate to expel gases discharged from the engine. Check the exhaust system regularly for leaks and make sure the exhaust manifolds/water-injected elbow is securely attached.
- Be sure the unit and its surroundings are well ventilated. Run blowers when running the generator set or engine.
- Do not run the generator set or engine unless the boat is equipped with a functioning marine carbon monoxide detector that complies with ABYCA-24. Consult your boat builder or dealer for installation of approved detectors.
- For additional information refer to ABYC T-22 (educational information on Carbon Monoxide).

⚠ WARNING: ***Carbon monoxide (CO) is an invisible odorless gas. Inhalation produces flu-like symptoms, nausea or death!***

- Do not use copper tubing in diesel exhaust systems. Diesel fumes can rapidly destroy copper tubing in exhaust systems. Exhaust sulfur causes rapid deterioration of copper tubing resulting in exhaust/water leakage.
- Do not install exhaust outlet where exhaust can be drawn through portholes, vents, or air conditioners. If the engine exhaust discharge outlet is near the waterline, water could enter the exhaust discharge outlet and close or restrict the flow of exhaust. Avoid overloading the craft.
- Although diesel engine exhaust gases are not as toxic as exhaust fumes from gasoline engines, carbon monoxide gas is present in diesel exhaust fumes. Some of the symptoms or signs of carbon monoxide inhalation or poisoning are:

Vomiting	Inability to think coherently
Dizziness	Throbbing in temples
Headache	Muscular twitching
Nausea	Weakness and sleepiness

AVOID MOVING PARTS

⚠ WARNING: ***Rotating parts can cause injury or death!***

- Do not service the engine while it is running. If a situation arises in which it is absolutely necessary to make operating adjustments, use extreme care to avoid touching moving parts and hot exhaust system components.

SAFETY INSTRUCTIONS

- Do not wear loose clothing or jewelry when servicing equipment; tie back long hair and avoid wearing loose jackets, shirts, sleeves, rings, necklaces or bracelets that could be caught in moving parts.
- Make sure all attaching hardware is properly tightened. Keep protective shields and guards in their respective places at all times.
- Do not check fluid levels or the drive belts tension while the engine is operating.
- Stay clear of the drive shaft and the transmission coupling when the engine is running; hair and clothing can easily be caught in these rotating parts.

HAZARDOUS NOISE

⚠ WARNING: ***High noise levels can cause hearing loss!***

- Never operate an engine without its muffler installed.
- Do not run an engine with the air intake (silencer) removed.
- Do not run engines for long periods with their enclosures open.

⚠ WARNING: ***Do not work on machinery when you are mentally or physically incapacitated by fatigue!***

OPERATORS MANUAL

Many of the preceding safety tips and warnings are repeated in your Operators Manual along with other cautions and notes to highlight critical information. Read your manual carefully, maintain your equipment, and follow all safety procedures.

GASOLINE ENGINE AND GENERATOR INSTALLATIONS

Preparations to install an engine should begin with a thorough examination of the American Boat and Yacht Council's (ABYC) standards. These standards are a combination of sources including the USCG and the NFPA.

Sections of the ABYC standards of particular interest are:

H-2 Ventilation
P-1 Exhaust Systems
P-4 Inboard Engines
E-9 DC Electrical Systems

All installations must comply with the Federal Code of Regulations (FCR).

ABYC, NFPA AND USCG PUBLICATIONS FOR INSTALLING DIESEL ENGINES

Read the following ABYC, NFPA and USCG publications for safety codes and standards. Follow their recommendations when installing your engine.

ABYC (American Boat and Yacht Council)
"Safety Standards for Small Craft"

Order from:

ABYC
3069 Solomon's Island Rd.
Edgewater, MD 21037

NFPA (National Fire Protection Association)
"Fire Protection Standard for Motor Craft"

Order from:

NFPA
11 Tracy Drive
Avon Industrial Park
Avon, MA 02322

USCG (United States Coast Guard)
"USCG 33CFR183"

Order from:

U.S. Government Printing Office
Washington, D.C. 20404

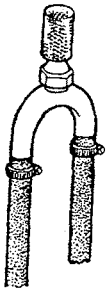
INSTALLATION

When installing WESTERBEKE engines and generators it is important that strict attention be paid to the following information:

CODES AND REGULATIONS

Strict federal regulations, ABYC guidelines, and safety codes must be complied with when installing engines and generators in a marine environment.

SIPHON-BREAK



AVAILABLE FROM YOUR WESTERBEKE DEALER

For installations where the exhaust manifold/water injected exhaust elbow is close to or will be below the vessel's waterline, provisions must be made to install a siphon-break in the raw water supply hose to the exhaust elbow. This hose must be looped a minimum of 20" above the vessel's waterline. ***Failure to use a siphon-break when the exhaust manifold/water injected exhaust elbow is near or below the loaded water line of the vessel will result in raw water damage to the engine and possible flooding of the vessel.***

If you have any doubt about the position of the water-injected exhaust elbow relative to the vessel's waterline under the vessel's various operating conditions, ***install a siphon-break.***

NOTE: *A siphon-break requires periodic inspection and cleaning to ensure proper operation. Failure to properly maintain a siphon-break can result in catastrophic engine damage. Consult the siphon-break manufacturer for proper maintenance.*

EXHAUST SYSTEM

The exhaust hose must be certified for marine use. The system must be designed to prevent water from entering the exhaust under any sea conditions and at any angle

A detailed 40 page Marine Installation Manual covering gasoline and diesel, engines and generators, is supplied with every unit.

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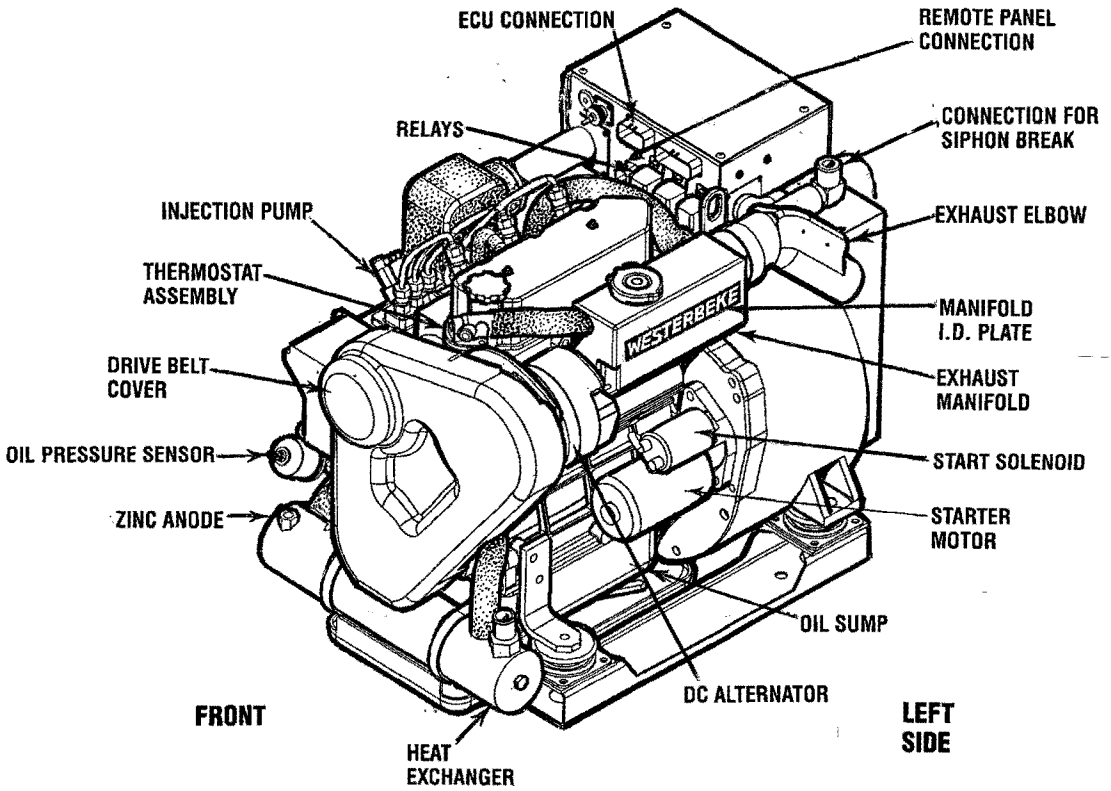
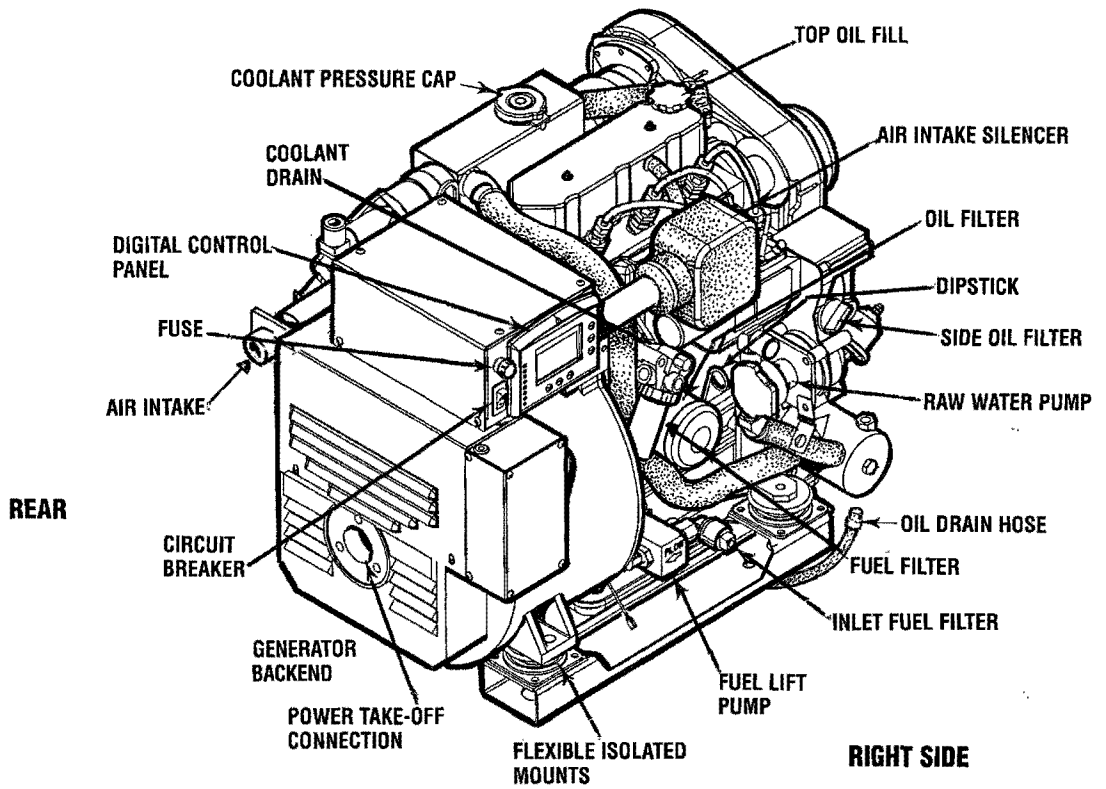
7.6KW GENERATOR
PARTS IDENTIFICATION





INTRODUCTION

This WESTERBEKE Diesel Generator is a product of WESTERBEKE's long years of experience and advanced technology. We take great pride in the superior durability and dependable performance of our engines and generators. Thank you for selecting WESTERBEKE.

In order to get the full use and benefit from your generator it is important that you operate and maintain it correctly. This manual is designed to help you do this. Please, read this manual carefully and observe all the safety precautions throughout. Should your generator require servicing, contact your nearest WESTERBEKE dealer for assistance.

This is your operators manual. A parts catalog is also provided and a technical manual is available from your WESTERBEKE dealer. If you are planning to install this equipment contact your WESTERBEKE dealer for WESTERBEKE'S installation manual.

WARRANTY PROCEDURES

Your WESTERBEKE Warranty is included in a separate folder. If, after 60 days of submitting the Warranty Registry form you have not received a customer identification card registering your warranty, please contact the factory in writing with model information, including the unit's serial number and commission date.

Customer Identification Card

WESTERBEKE
Engines & Generators

Customer Identification
MR. GENERATOR OWNER
MAIN STREET
HOMETOWN, USA
Model Ser. #
Expires

PRODUCT SOFTWARE

Product software, (tech data, parts lists, manuals, brochures and catalogs), provided from sources other than WESTERBEKE are not within WESTERBEKE's control.

WESTERBEKE CANNOT BE RESPONSIBLE FOR THE CONTENT OF SUCH SOFTWARE, MAKES NO WARRANTIES OR REPRESENTATIONS WITH RESPECT THERETO, INCLUDING ACCURACY, TIMELINESS OR COMPLETENESS THEREOF AND WILL IN NO EVENT BE LIABLE FOR ANY TYPE OF DAMAGE OR INJURY INCURRED IN CONNECTION WITH OR ARISING OUT OF THE FURNISHING OR USE OF SUCH SOFTWARE.

WESTERBEKE customers should also keep in mind the time span between printings of WESTERBEKE product software and the unavoidable existence of earlier WESTERBEKE manuals. In summation, product software provided with WESTERBEKE products, whether from WESTERBEKE or other suppliers, must not and cannot be relied upon exclusively as the definitive authority on the respective product. It not only makes good sense but is imperative that appropriate representatives of WESTERBEKE or the supplier in question be consulted to determine the accuracy and currentness of the product software being consulted by the customer.

NOTES, CAUTIONS AND WARNINGS

As this manual takes you through the operating procedures, maintenance schedules, and troubleshooting of your marine engine, critical information will be highlighted by NOTES, CAUTIONS, and WARNINGS. An explanation follows:

NOTE: *An operating procedure essential to note.*

⚠ **CAUTION:** ***Procedures, which if not strictly observed, can result in the damage or destruction of your engine.***

⚠ **WARNING:** ***Procedures, which if not properly followed, can result in personal injury or loss of life.***

INTRODUCTION

SERIAL NUMBER LOCATION

The engine and generator serial numbers and model numbers are located on a decal on the generator housing. Take the time to enter this information on the illustration of the name-plate shown below, as this will provide a quick reference when seeking technical information and/or ordering repair parts.

SPECIFICATION	50 HZ.	60 HZ.
MODEL		
RPM		
KW		
KVA		
VOLTS		
AMPS		
ENG. HP		
ENG. SER. NO.		
GEN. SER. NO.		
PF/PHASE	/	
WIRES		
RATING		
INSUL. CLASS		
TEMP. RISE		
BATTERY		
C.I.D.		

The engine serial number can also be found stamped into the engine block just above the injection pump. The generator serial number is stamped into the generator housing on the flat surface on the left side of the generator.

An identification plate on the engine manifold also displays the engine model and serial number.

NOTE: *A carbon monoxide warning decal has been provided by WESTERBEKE. Affix this decal in a visible position in the engine room.*

UNDERSTANDING THE DIESEL ENGINE

The diesel engine closely resembles the gasoline engine, since the mechanism is essentially the same. The cylinders are arranged above a closed crankcase;the crankshaft is of the same general type as that of a gasoline engine, and the diesel engine has the same type of valves, camshaft, pistons, connecting rods and lubricating system.

Therefore, to a great extent, a diesel engine requires the same preventive maintenance as a gasoline engine. The most important factors are proper ventilation and proper maintenance of the fuel, lubricating and cooling systems. Replacement of fuel and lubricating filter elements at the time periods specified is a must, and frequent checking for contamination (that is water, sediment, etc.) in the fuel system is also essential. Another important factor is the use of the same brand of high detergent diesel lubrication oil designed specifically for diesel engines.

The diesel engine does differ from the gasoline engine, however, in its method of handling and firing of fuel. The carburetor and ignition systems are replaced by a single component – the fuel injection pump – which performs the function of both.

ORDERING PARTS

Whenever replacement parts are needed, always provide the generator model number, engine serial number, and generator serial number as they appear on the silver and black name-plate located on the generator end. You must provide us with this information so we may properly identify your generator set. In addition, include a complete part description and part number for each part needed (see the separately furnished Parts List). Insist upon WESTERBEKE packaged parts because *will fit* or generic parts are frequently not made to the same specifications as original equipment.

SPARES AND ACCESSORIES

Certain spares will be needed to support and maintain your WESTERBEKE engine. Your local WESTERBEKE dealer will assist you in preparing an inventory of spare parts. See the *SPARE PARTS* page in this manual. For engine accessories, see WESTERBEKE'S *ACCESSORIES* brochure.

INSTALLATION MANUAL

Publication #43400 provides detailed information for installing generators and is available at your WESTERBEKE dealer.

DIESEL FUEL, ENGINE OIL AND ENGINE COOLANT

DIESEL FUEL

Use fuel that meets the requirements or specification of Class 2-D (ASTM), and has a cetane rating of #45 or better.

Care Of The Fuel Supply

Use only clean diesel fuel! The clearance of the components in your fuel injection pump is very critical; invisible dirt particles which might pass through the filter can damage these finely finished parts. It is important to buy clean fuel, and keep it clean. The best fuel can be rendered unsatisfactory by careless handling or improper storage facilities. To assure that the fuel going into the tank for your engine's daily use is clean and pure, the following practice is advisable:

Purchase a well-known brand of fuel.

Install and regularly service a good, visual-type fuel filter/water separator between the fuel tank and the engine. The Racor 120R is a good example of such a filter.

ENGINE OIL

Use a heavy duty engine oil with an API classification of CF, CG-4, CH-4 or CI-4. Change the engine oil after an initial 50 hours of break-in operation, and every 100 hours of operation thereafter. For recommended oil use SAE 15W-40 (oil viscosity). WESTERBEKE recommends the use of synthetic oil.

> ⚠ **CAUTION:** ***Do not allow two or more brands of engine oil to mix. Each brand contains its own additives; additives of different brands could react in the mixture to produce properties harmful to your engine.***

ENGINE COOLANT

WESTERBEKE recommends a mixture of 50% antifreeze and 50% distilled water. Distilled water is free from the chemicals that can corrode internal engine surfaces.

The antifreeze performs double duty. It allows the engine to run at proper temperatures by transferring heat away from the engine to the coolant, and lubricates and protects the cooling circuit from rust and corrosion. Look for a good quality antifreeze that contains Supplemental Cooling Additives (SCAs) that keep the antifreeze chemically balanced, crucial to long term protection.

The distilled water and antifreeze should be premixed before being poured into the cooling circuit.

NOTE: *Look for the new environmentally-friendly long lasting antifreeze that is now available.*

PURCHASING ANTIFREEZE

Rather than preparing the mixture, WESTERBEKE recommends buying the premixed antifreeze so that so that when adding coolant the mixture will always be correct.

There are two common types of antifreeze, Ethylene Glycol (green) and Propylene Glycol (red/purple), either can be used but do not mix the two and if changing from one to another, flush the engine thoroughly.

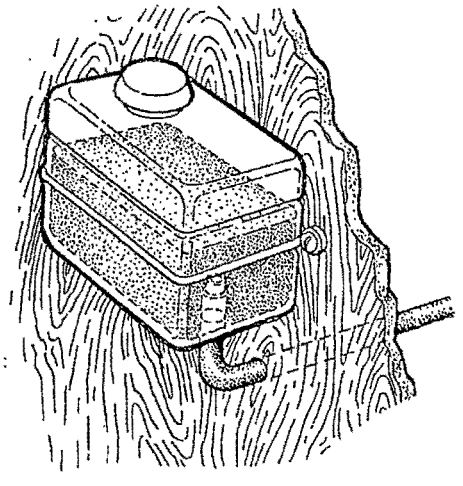
Premixed antifreeze for GASOLINE Engines: Specification #ASTM 4656.

MAINTENANCE

Change the engine coolant every five years regardless of the number of operating hours as the chemical additives that protect and lubricate the engine have a limited life.

COOLANT RECOVERY TANK

A coolant recovery tank kit is supplied with each generator. The purpose of this recovery tank is to allow for engine coolant expansion and contraction during engine operation, without the loss of coolant and without introducing air into the cooling system.



PREPARATIONS FOR INITIAL START-UP

PRESTART INSPECTION

Before starting your generator set for the first time or after a prolonged layoff, check the following items:

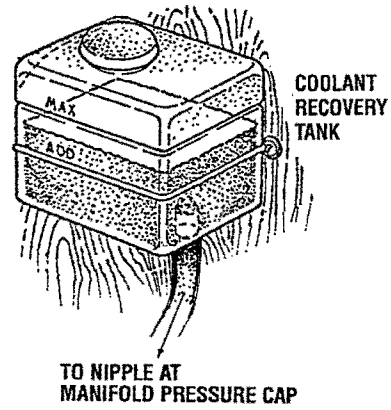
- Make certain the cooling water thru-hull petcock is open.
- Check the engine oil level: add oil to maintain the level at the full mark on the dipstick.
- Check the fuel supply and examine the fuel filter/separator bowls for contaminant's.
- Check the DC electrical system. Inspect wire connections and battery cable connections.
- Check load leads for correct connection as specified in the wiring diagrams.
- Examine air inlet and outlet for air flow obstructions.
- Be sure no other generator or utility power is connected to load lines.
- Be sure that in power systems with a neutral line that the neutral is properly grounded (or ungrounded) as the system requires, and that the generator neutral is properly connected to the load neutral. In single phase systems an incomplete or open neutral can supply the wrong line-to-neutral voltage on unbalanced loads.
- Visually examine the unit. Look for loose or missing parts, disconnected wires, unattached hoses, and check threaded connections. Search for any gasoline leaks.

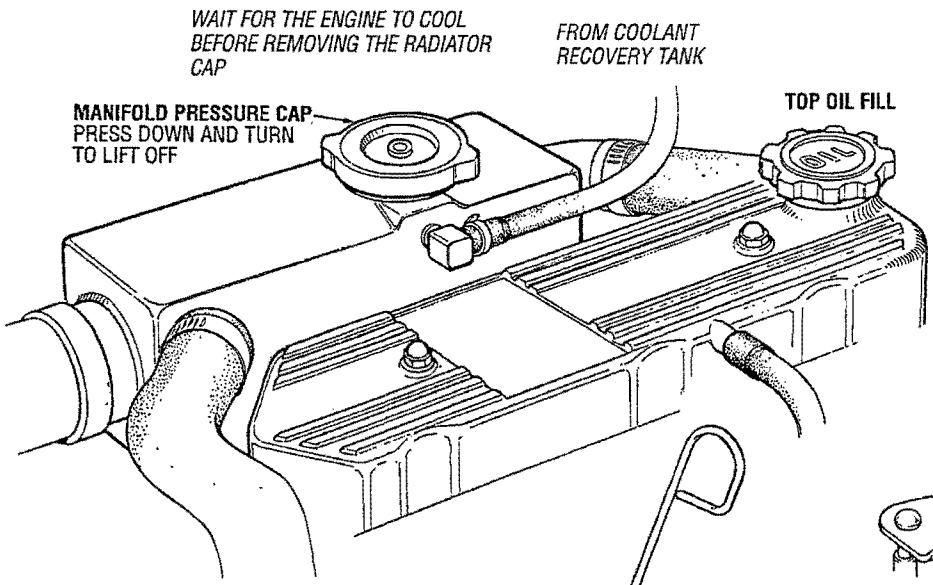
> ⚠ **CAUTION:** ***When starting the generator, it is recommended that all AC loads, especially large motors, be switched OFF until the engine has come up to speed and, in cold climates, starts to warm up. This precaution will prevent damage caused by unanticipated operation of the AC machinery and will prevent a cold engine from stalling.***

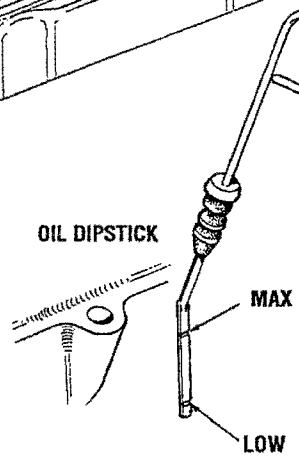
- Check the coolant level in both the plastic recovery tank and at the manifold.

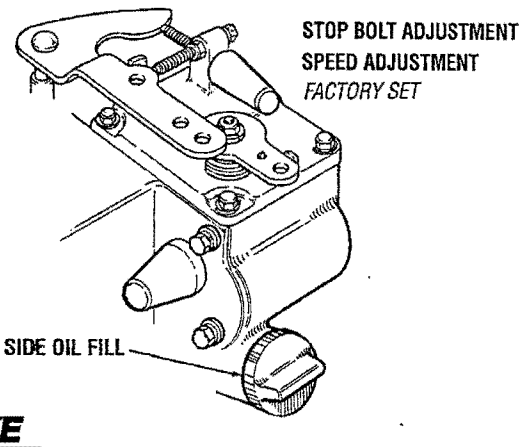
NOTE: *After the initial running of the generator, the air in the engine's cooling system will be purged to the coolant recovery tank. Open the air bleed petcock to ensure that the cooling system is purged of air. After shutdown and after the engine has cooled, the coolant from the recovery tank will be drawn into the engine's cooling system to replace the purged air.*

Before subsequent operation of the generator, the engine's manifold should be topped off, and the coolant recovery tank may need to be filled to the MAX level.



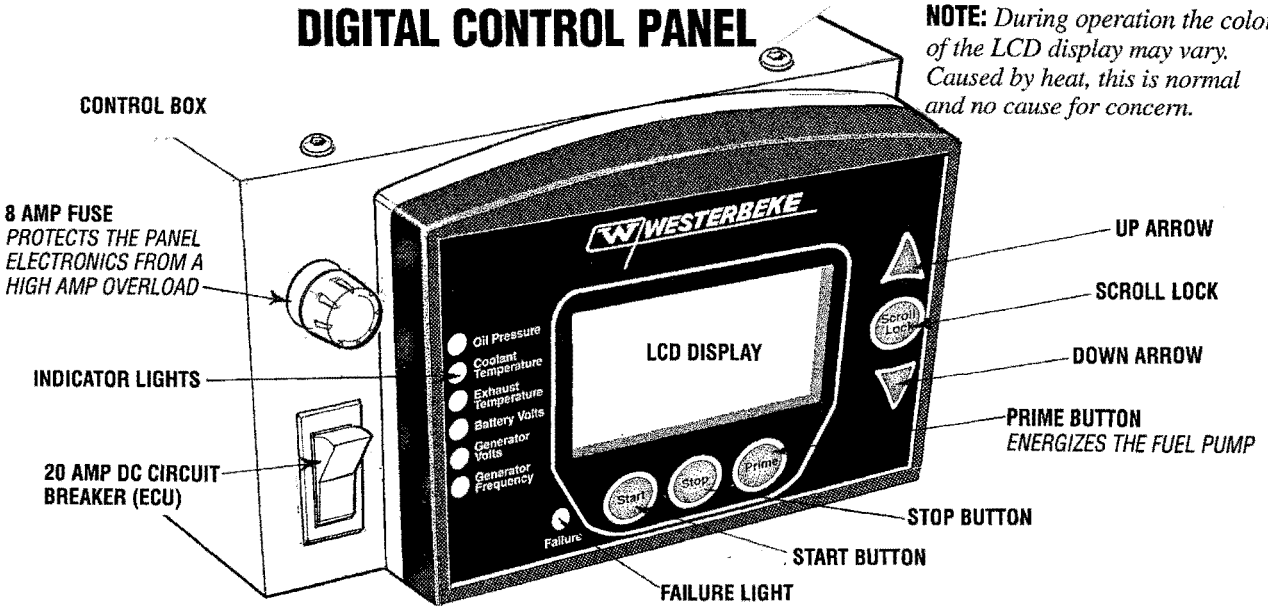

WAIT FOR THE ENGINE TO COOL BEFORE REMOVING THE RADIATOR CAP
FROM COOLANT RECOVERY TANK
MANIFOLD PRESSURE CAP
PRESS DOWN AND TURN TO LIFT OFF
TOP OIL FILL
OIL





DIGITAL CONTROL PANEL

NOTE: *During operation the color of the LCD display may vary. Caused by heat, this is normal and no cause for concern.*

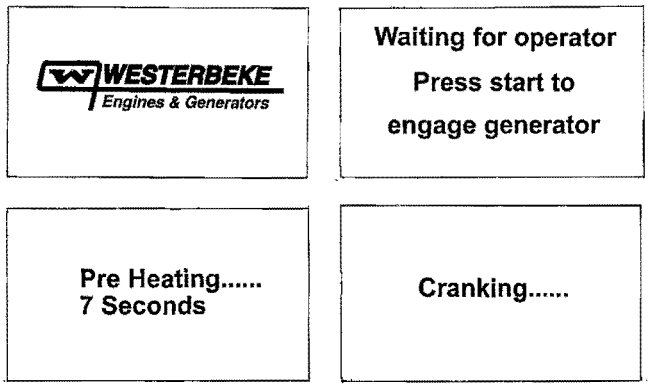


DESCRIPTION

WESTERBEKE'S Digital Control panel provides the operator with an LCD display that continuously monitors all the operations of the generator in easy to understand text messages.

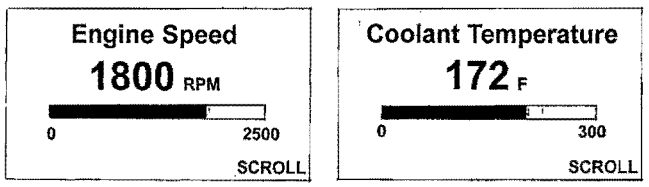
START SEQUENCE

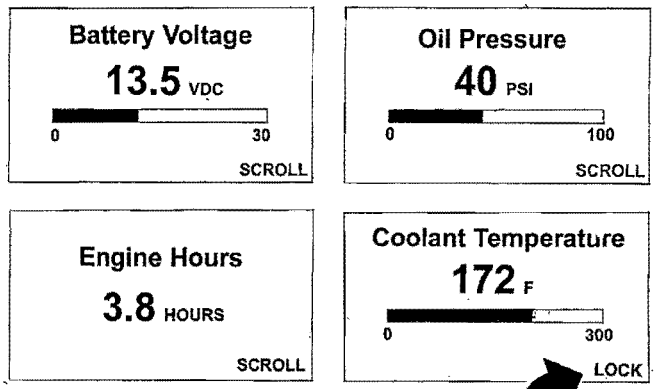
With the prestart inspection completed, Press the START button and the automatic sequence will begin. The six indicator lights will illuminate green and the panel will display the following text:



RUN SEQUENCE

As the display cycles thru the engine functions, the speed will come up to 1800 rpms-60Hz (1500 rpms-50Hz) and the oil pressure and engine coolant will rise to their normal readings. The functions will cycle in the following sequence:





SCROLL LOCK

To stop the continuing sequence, press the SCROLL LOCK button. This enables the operator to monitor a single function for any length of time. The word LOCK will appear in the corner. use the *up* and *down* arrows to find and observe other functions. To resume scrolling, press the SCROLL LOCK button again.

Up and Down Arrows

When the display is in its cycling mode, the UP and DOWN arrows can be used to adjust the dark and light contrast of the screen.

FUEL PRIMING

Use the PRIME button on the digital control panel to purge air and bring fuel back into the fuel lines after performing fuel filter maintenance.

LCD DISPLAY

Periodically clean the control panel and its LCD screen using a soft cloth.

NOTE: *Operating temperatures may cause the LCD display to vary in color. This is normal and a change in color will not affect the operation of the control panel.*

DIGITAL CONTROL PANEL

STOP SEQUENCE

To stop the generator, press the STOP button. The display will cycle thru the following text messages and shutdown.

Shutting Down	Waiting for operator Press start to engage generator

Engine Shutdown

THE CONTROL PANEL WILL POWER DOWN AND IN A FEW MOMENTS THE DISPLAY WILL GO BLANK

FAILURE LIGHT/SHUTDOWN

If a problem occurs, the generator will shutdown and the FAILURE light will illuminate red. In addition, one of the indicator lights will change from green to orange to reveal where the trouble has occurred and the display will text message what has happened.

NOTE: When servicing/changing DC components. The DC power **must be turned off** using either the DC breaker or the battery switch.

Examples:

*Failure Light is **red.***

*Coolant Temperature Light is **orange.***

High Engine Temp.

Reset ECU to ReStart

*Failure Light is **red.***

*Oil Pressure Light is **orange.***

Low Oil Pressure

Reset ECU to Restart

When a failure occurs, refer to the troubleshooting chart, wiring diagram, and general operating text in this manual to assist in solving the trouble.

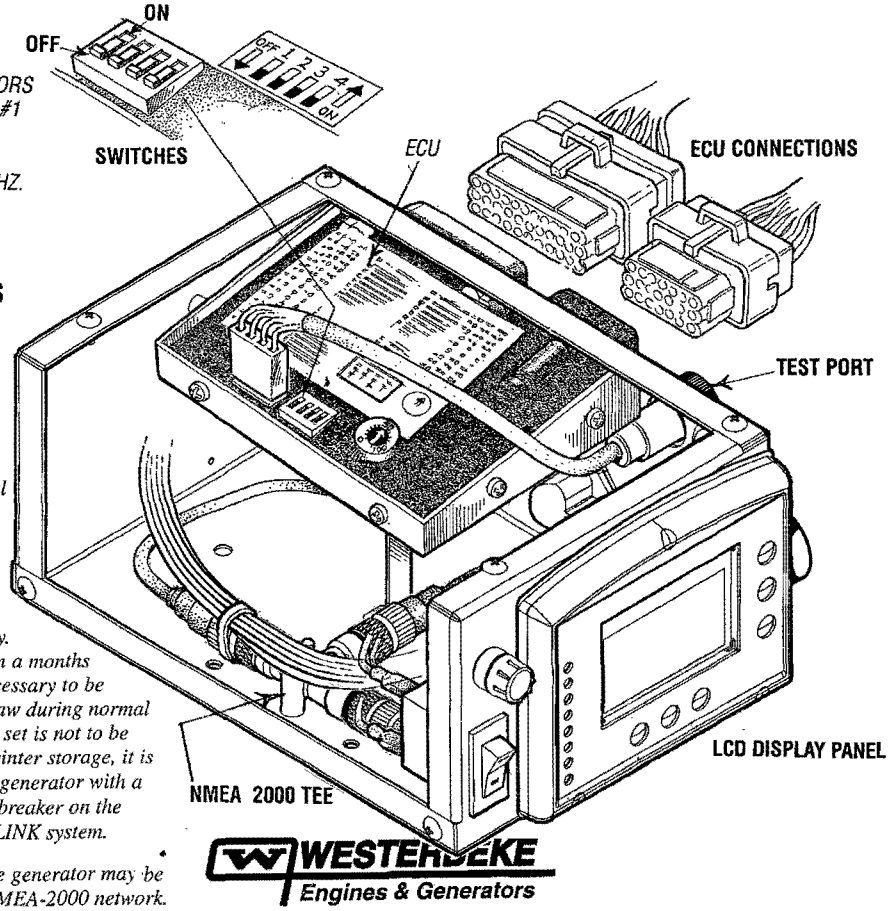
There are many combinations of messages that can be displayed but they are all self explanatory and the operator can easily isolate and correct the problem should one occur.

Before restarting the generator, the 20 amp DC circuit breaker ***must*** be pushed to the OFF position, and back to the ON position to reset the ECU. Once the problem is corrected and the generator is restarted, the LCD display will begin cycling again.

---

*WHEN CHANGING THE GENERATORS FREQUENCY (50/60 HZ) SWITCH #1 ON THE CONTROL PANEL ECU BOARD MUST BE SWITCHED: **ON** FOR 50 HZ AND **OFF** FOR 60 HZ.*

CONTROL BOX INTERNAL COMPONENTS



CAUTION (WESTERLINK or NMEA-2000): *The electronic components in the Digital Diesels draw a very small amount of amperage (milli-amps) from the generator's starting battery when the unit is in a static state. This maybe as much as 50 milli-amps for the system ECU and 50 milli-amps for each display. This can be as much as 72 amp-hours in a months time with no generator use. It is not necessary to be concerned with this slight amperage draw during normal seasonal use. However, if the generator set is not to be used for a number of months, such as winter storage, it is best to disconnect the DC power to the generator with a NMEA-2000 system or shut off the DC breaker on the generator's control box for a WESTERLINK system.*

NOTE: *Keep in mind that the Westerbeke generator may be the DC power supply for the vessel's NMEA-2000 network.*

WESTERBEKE
Engines & Generators

GENERATOR BREAK-IN PROCEDURE

DESCRIPTION

Although your engine has experienced a minimum of one hour of test operations at the factory to make sure accurate assembly procedures were followed and that the engine operated properly, a break-in time is required. The service life of your engine is dependent upon how the engine is operated and serviced during its initial hours of use.

Breaking-in a new engine basically involves seating the piston rings to the cylinder walls. Excessive oil consumption and smoky operation indicate that the cylinder walls are glazed or scored, which is caused by overloading the engine during the break-in period.

Your new engine requires approximately 50 hours of initial conditioning operation to break in each moving part in order to maximize the performance and service life of the engine. Perform this conditioning carefully, keeping in mind the following:

Start the engine according to the *STARTING PROCEDURE* section. Run the engine while checking that all systems (raw water pump, oil pressure, battery charging) are functioning.

AFTER START-UP

Once the generator has been started, check for proper operation and then encourage a fast warm-up. Run the generator between 20% and 60% of full-load for the first 10 hours.

After the first 10 hours of the generator's operation, the load can be increased to the full-load rated output, then periodically vary the load.

Avoid overload at all times. An overload is signaled by smoky exhaust with reduced output voltage and frequency. Monitor the current being drawn from the generator and keep it within the generator's rating. Since the generator operates at 1800 rpm to produce 60 hertz (or at 1500 rpm to produce 50 Hertz), control of the generator's break-in is governed by the current drawn from the generator.

NOTE: *Be aware of motor starting loads and the high current draw required for starting motors. This starting amperage draw can be 3 to 5 times normal running amperage. See* GENERATOR INFORMATION *in this manual.*

GENERATOR ADJUSTMENTS

Once the generator has been placed in operation, there may be governor adjustments required for engine speed (hertz) during the engine's break-in period (first 50 hours) or after this period see *ENGINE SPEED (HERTZ) ADJUSTMENT)* under *ENGINE ADJUSTMENTS*.. A no-load voltage adjustment may also be required in conjunction with the engine's speed adjustment see *GENERATOR INFORMATION.*

THE DAILY ROUTINE

CHECK LIST

Follow this check list each day before starting your generator.

- Check that all generator circuit breakers (power panel) are in the off position before starting.
- Record the hourmeter reading in your log (engine hours relate to the maintenance schedule.)

  Any deficiency or problems in the following items must be corrected before start up.
- Visually inspect the engine for fuel, oil, or water leaks.
- Check the oil level (dipstick).
- Check the coolant level in the coolant recovery tank.
- Check your fuel supply.
- Check the starting batteries (weekly).
- Check drive belts for wear and proper tension (weekly).

CHECK WITH THE ENGINE RUNNING.

- Check for abnormal noise such as knocking, vibrating and blow-back sounds.
- Confirm exhaust smoke:
  When the engine is cold - White Smoke.
  When the engine is warm - almost Smokeless.
  When the engine is overloaded - some Black Smoke.

NOTE: *Some unstable running may occur in a cold engine. This condition should abate as normal operating temperature is reached and loads are applied.*

> ⚠ **CAUTION:** ***Do not operate the generator for long periods of time without a load being placed on the generator.***

STOPPING THE GENERATOR

Remove the AC loads from the generator one at a time.Allow the generator to run for 3-5 minutes to stabilize the operating temperature, then turn the key to the off position. Once the generator is shutdown, close down all circuit breakers as a safety precaution.

MAINTENANCE SCHEDULE

> ⚠ **WARNING:** ***Never attempt to perform any service while the engine is running. Wear the proper safety equipment such as goggles and gloves, and use the correct tools for each job. Disconnect the battery terminals when servicing any of the engine's DC electrical equipment.***

NOTE: *Many of the following maintenance jobs are simple but others are more difficult and may require the expert knowledge of a service mechanic.*

SCHEDULED MAINTENANCE	CHECK EACH DAY	HOURS OF OPERATION							EXPLANATION OF SCHEDULED MAINTENANCE
		50	100	250	500	750	1000	1250	
Fuel Supply	☐								Diesel No. 2 rating of 45 cetane or higher.
Fuel/Water Separator	☐								Check for water and dirt in fuel (drain/replace filter if necessary).
Engine Oil Level	☐								Oil level should indicate between MAX. and LOW on dipstick.
Coolant Level	☐								Check at recovery tank; if empty, check at manifold. Add coolant if needed.
Drive Belts	☐ weekly								Inspect for proper tension (3/8" to 1/2" deflection) and adjust if needed. Check belt edges for wear.
Visual Inspection of Engine	☐	**NOTE:** *Please keep engine surface clean. Dirt and oil will inhibit the engine's ability to remain cool.*							Check for fuel, oil and water leaks. Inspect wiring and electrical connections. Keep bolts & nuts tight. Check for loose belt tension.
Fuel Filter & Inlet Filter		☐		☐	☐	☐	☐	☐	Initial change at 50 hrs, then change every 250 hrs.
Starting Batteries (and House Batteries)	☐ weekly								Every 50 operating hours check electrolyte levels and make sure connections are very tight. Clean off excessive corrosion.
Engine Oil (and filter)		☐	☐	☐	☐	☐	☐	☐	Initial engine oil & filter change at 50 hrs., then change both every **100** hours.
Generator		☐	☐	☐	☐	☐	☐	☐	Check that AC connections are clean and secure with no chafing. See *GENERATOR SECTION* for additional information.
Heat Exchanger Zinc Anode		☐	☐	☐	☐	☐	☐	☐	Inspect zinc anode, replace if needed, clear the heat exchanger end of zinc anode debris.
Fuel/Water Separator			☐	☐	☐	☐	☐	☐	Change every 200 hours.
Sea Water Pump					☐		☐		Remove pump and inspect impeller drive shaft end for wear. Inspect drive gear slot for wear. Repair/replace as needed.
Exhaust System		☐		☐		☐		☐	Initial check at 50 hrs., then every 250 hrs. Inspect for leaks. Check anti-siphon valve operation. Check the exhaust elbow for carbon and/or corrosion buildup on inside passages; clean and replace as necessary. Check that all connections are tight.
Engine Hoses			☐	☐	☐	☐	☐	☐	Hose should be hard & tight. Replace if soft or spongy. Check and tighten all hose clamps.

MAINTENANCE SCHEDULE

NOTE: *Use the engine hour meter gauge to log your engine hours or record your engine hours by running time.*

SCHEDULED MAINTENANCE	CHECK EACH DAY	HOURS OF OPERATION							EXPLANATION OF SCHEDULED MAINTENANCE
		50	100	250	500	750	1000	1250	
Raw Water Pump				☐		☐		☐	Remove the pump cover and inspect impeller, gasket, cam and cover for wear. Check the bearings and seals (the shaft can turn, but not wobble). Lubricate when reassembling.
Coolant System					☐			☐	Drain, flush, and refill cooling system with appropriate antifreeze mixture compatible with various cooling system metals.
Electric Fuel Lift Pump		☐		☐	☐	☐	☐	☐	Periodically check the wiring connections and inspect the fuel line connections.
Inlet Fuel Filter				☐	☐	☐	☐	☐	Replace.
DC Alternator				☐		☐		☐	Check DC charge from alternator. Check the mounting bracket; tighten electrical connections.
*Fuel Injectors						☐			Check and adjust injection opening pressure and spray condition (see *ENGINE ADJUSTMENTS*).
*Starter Motor					☐			☐	Check solenoid and motor for corrosion. Remove and lubricate. Clean and lubricate the starter motor pinion drive.
*Preheat Circuit					☐			☐	Check operation of preheat solenoid. Remove and clean glow plugs; check resistance (4-6 ohms). Reinstall with anti seize compound on threads.
*Engine Cylinder Compression					☐			☐	Check compression pressure and timing (see *Engine Adjustments*).
*Torque Cylinder Head Hold-down bolts		☐			☐		☐		At first 50 hours, then every 500 hours (see *ENGINE ADJUSTMENTS*).
*Adjust the Valve Clearances		☐			☐		☐		Adjust Valve Clearances (see *ENGINE ADJUSTMENTS*).
*Heat Exchanger							☐		Remove, have professionally cleaned and pressure tested.

*WESTERBEKE recommends this service be performed by an authorized mechanic.

NOTE: When servicing/changing DC components. The DC power **must be turned off using** either the DC breaker or the battery switch.

CAUTION (WESTERLINK or NMEA-2000): *The electronic components in the Digital Diesels draw a very small amount of amperage (milli-amps) from the generator's starting battery when the unit is in a static state. This maybe as much as 50 milli-amps for the system ECU and 50 milli-amps for each display. This can be as much as 72 amp-hours in a months time with no generator use. It is not necessary to be concerned with this slight amperage draw during normal seasonal use. However, if the generator set is not to be used for a number of months, such as winter storage, it is best to disconnect the DC power to the generator with a NMEA-2000 system or shut off the DC breaker on the generator's control box for a WESTERLINK system.*

NOTE: *Keep in mind that the Westerbeke generator may be the DC power supply for the vessel's NMEA-2000 network.*

FUEL SYSTEM

DIESEL FUEL

Use No. 2 diesel fuel with a cetane rating of 45 or higher. Do not use kerosene or home heating fuel.

FUEL FILTERS

The fuel injection pump and the fuel injectors are precisely manufactured and they must receive clean diesel fuel, free from water and dirt. To ensure this flow of clean fuel, the fuel must pass through at least two fuel filters, a fuel water separator and the engine's spin-on fuel filter. Visually inspect, clean, and change these filters according to the maintenance schedule in this manual.

FUEL WATER SEPARATOR

A primary fuel filter of the water separating type must be installed between the fuel tank and the engine to remove water and other contaminants from the fuel before they can be carried to the fuel system on the engine.

The owner/operator is responsible for making certain the fuel reaching the engine's injection equipment is free of impurities. This process is accomplished by installing and maintaining a proper fuel filter/water separator between the fuel tank and the generator/engine. Westerbeke recommends a 10 micron filter be used.

FUEL INJECTION PUMP

The fuel injection pump is the most important component of the diesel engine, requiring the utmost caution in handling. The fuel injection pump has been thoroughly bench-tested and the owner/operator is cautioned not to attempt to service it. If it requires servicing, remove it and take it to an authorized fuel injection pump service facility. Do not attempt to disassembly and repair it.

FUEL LIFT PUMP

Periodically check the fuel connections to and out of the pump and make sure that no leakage is present and that the fittings are tight and secure. The DC ground connection at one of the pump's mounting bolts should be clean and well secured by the mounting bolt to ensure proper pump operation.

When energized thru the preheat circuit, the fuel lift pump will purge air from the fuel system and provide a continuous flow of fuel as the engine is running.

INLET FUEL FILTER

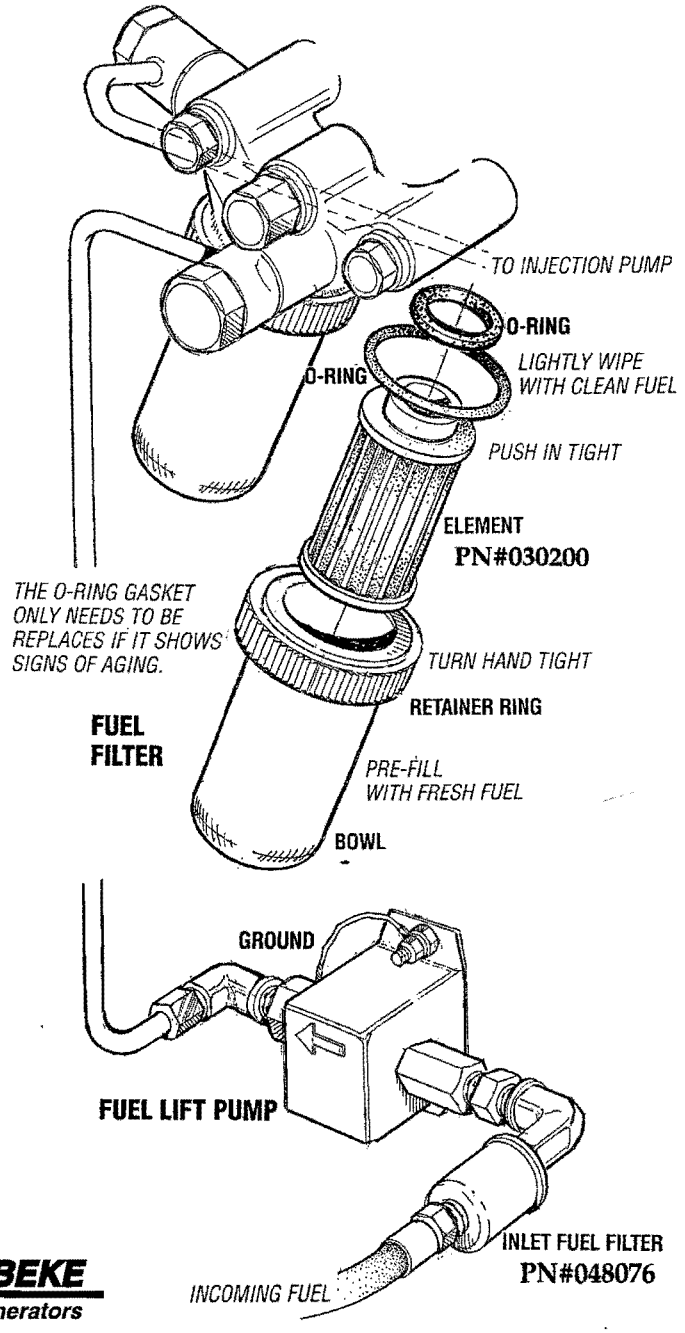
To ensure clean fuel into the fuel lift pump, there is a small in-line fuel filter connected to the fuel lift pump elbow.

ENGINE FUEL FILTER

Periodically check the fuel connections and the bowl for leakage. Replace the filter element after the first 50 hours then follow the *MAINTENANCE SCHEDULE.*

Changing/cleaning the filter element

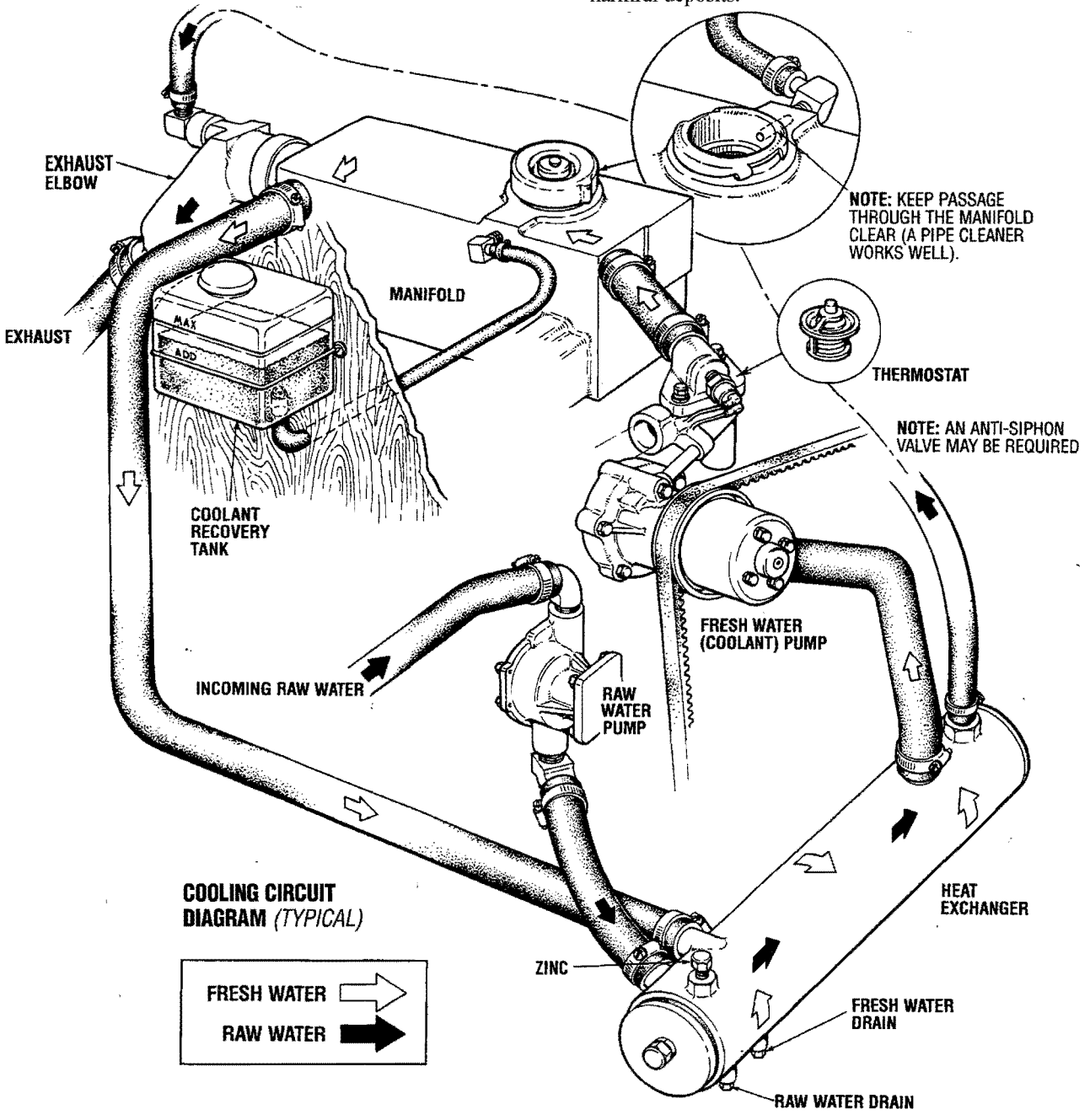
1. Shut off the fuel supply.
2. Unscrew the retainer ring that holds the filter bowl to the housing and allow the bowl to come away from the housing,
3. Remove and replace the filter element and clean the bowl.
4. Replace the sealing "O" ring and reassemble the bowl to the housing. Thread the retainer ring on carefully so as not to cross thread. When retainer contacts the "O" ring, tighten 1/4 - 1/2 turns by hand. Open the fuel supply and run the engine to inspect for leaks.



COOLING SYSTEM

DESCRIPTION

Westerbeke marine diesel engines are designed and equipped for fresh water cooling. Heat produced in the engine by combustion and friction is transferred to fresh water coolant which circulates throughout the engine. This circulating fresh water coolant cools the engine block, its internal moving parts, and the engine oil. The heat is transferred externally from the fresh water coolant to raw water by means of a heat exchanger, similar in function to an automotive radiator. Raw water flows through the tubes of the heat exchanger while fresh water coolant flows around the tubes; engine heat transferred to the fresh water coolant is conducted through the tube walls to the raw water which is then pumped into the exhaust system where finally it is discharged overboard. In other words, the engine is cooled by fresh water coolant, this coolant is cooled by raw water, and the raw water carries the transferred heat overboard through the exhaust system. The fresh water coolant and raw water circuits are independent of each other. Using only fresh water coolant within the engine allows the cooling water passages to stay clean and free from harmful deposits.



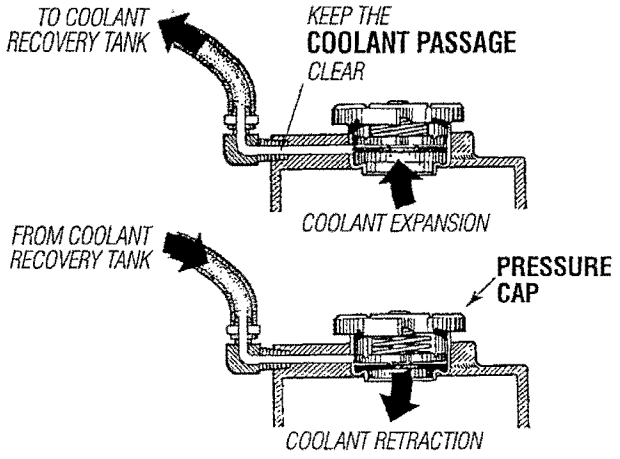
COOLING CIRCUIT DIAGRAM *(TYPICAL)*

FRESH WATER COOLING CIRCUIT

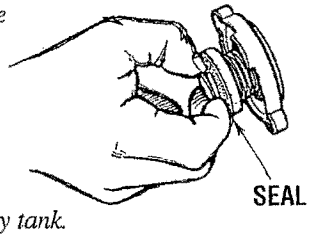
NOTE: *Refer to the ENGINE COOLANT section for the recommended antifreeze and water mixture to be used as the fresh water coolant.*

Fresh water coolant is pumped through the engine by a circulating pump, absorbing heat from the engine. The coolant then passes through the thermostat into the manifold, to the heat exchanger where it is cooled, and returned to the engine block via the suction side of the circulating pump.

When the engine is started cold, external coolant flow is prevented by the closed thermostat (although some coolant flow is bypassed around the thermostat to prevent the exhaust manifold from overheating). As the engine warms up, the thermostat gradually opens, allowing full flow of the engine's coolant to flow unrestricted to the external portion of the cooling system.



NOTE: *Periodically check the condition of the manifold pressure cap. Ensure the upper and lower rubber seals are in good condition. Check to ensure the vacuum valve opens and closes tightly. Carry a spare cap. Check also to ensure the coolant passage is clear so coolant within the system is able to expand and contract to and from the coolant recovery tank.*



Coolant Recovery Tank

The coolant recovery tank allows for the expansion and contraction of the engines coolant during engine operation without introducing air into the system. This recovery tank is provided with fresh water cooled models and with the fresh water coolant conversion kit and must be installed before operating the engine.

NOTE: *This tank, with its short run of plastic hose, is best located at or above the level of the engine's manifold.*

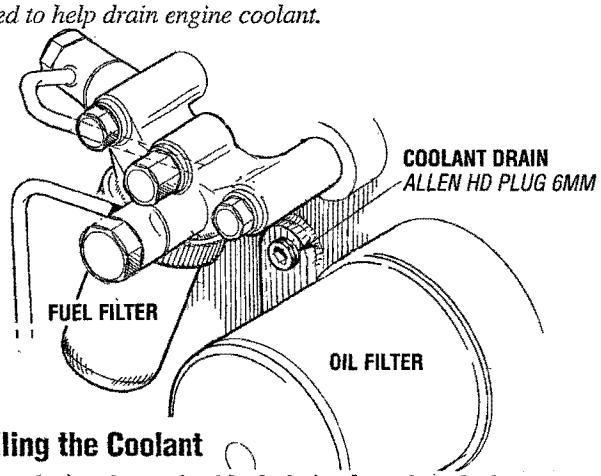
CHANGING COOLANT

The engine's coolant must be changed according to the *MAINTENANCE SCHEDULE*. If the coolant is allowed to become contaminated, it can lead to overheating problems.

> **⚠ CAUTION:** ***Proper cooling system maintenance is critical; a substantial number of engine failures can be traced back to cooling system corrosion.***

Drain the engine coolant by removing the drain plug on the engine block and opening the manifold pressure cap. Flush the system with fresh water, then reinstall the drain and start the refill process.

NOTE: *The drain petcock on the heat exchanger should also be used to help drain engine coolant.*



Refilling the Coolant

After replacing the engine block drain plug, close the heat exchanger's coolant petcock. Then run the engine at idle and slowly pour clean, premixed coolant into the manifold.

Monitor the coolant in the manifold and add as needed. Fill the manifold to the filler neck and install the manifold pressure cap.

Remove the cap on the coolant recovery tank and fill with coolant mix to halfway between LOW and MAX and replace the cap. Run the engine and observe the coolant expansion flow into the recovery tank.

After checking for leaks, stop the engine and allow it to cool. Coolant should draw back into the cooling system as the engine cools down. Add coolant to the recovery tank if needed and check the coolant in the manifold. Clean up any spilled coolant.

AIR INTAKE/COOLING

Clean air is drawn into the engine thru the air intake at the top side of the generators backend. The air serves two functions: it cools the electronics in the control box and provides clean fresh air for engine combustion.

The generators air intake must have "breathing space" and be clear from obstruction and the air intake hose should periodically be inspected to be sure it is also free from obstruction.

> **⚠ CAUTION:** ***Never perform air intake maintenance with the generator running.***

COOLING SYSTEM

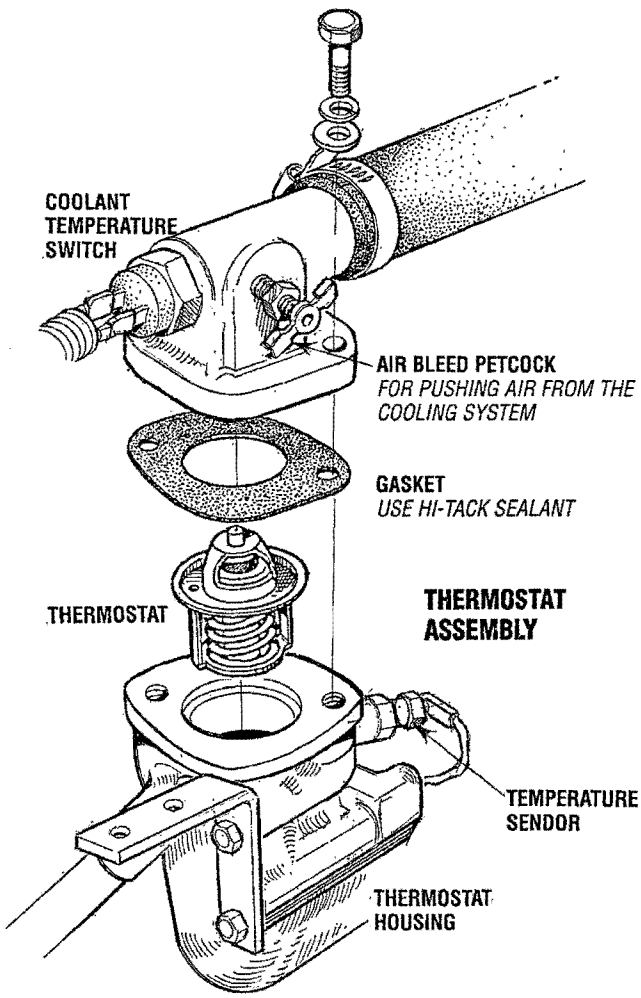
THERMOSTAT

A thermostat, located near the manifold at the front of the engine, controls the coolant temperature as the coolant continuously flows through the closed cooling circuit. When the engine is first started, the closed thermostat prevents coolant from flowing (some coolant is by-passed through a hole in the thermostat to prevent the exhaust manifold from overheating). As the engine warms up, the thermostat gradually opens. The thermostat is accessible and can be checked, cleaned, or replaced easily. Carry a spare thermostat and gasket

Replacing the Thermostat

Remove the cap screws and disassemble the thermostat housing as shown. When installing the new thermostat and gasket, apply a thin coat of sealant on both sides of the gasket before pressing it into place. Do *not* over-tighten the cap screws.

Run the engine and check for normal temperatures and that there are no leaks at the thermostat housing.



RAW WATER INTAKE STRAINER

NOTE: *Always install the strainer at or below the waterline so the strainer will always be self-priming.*

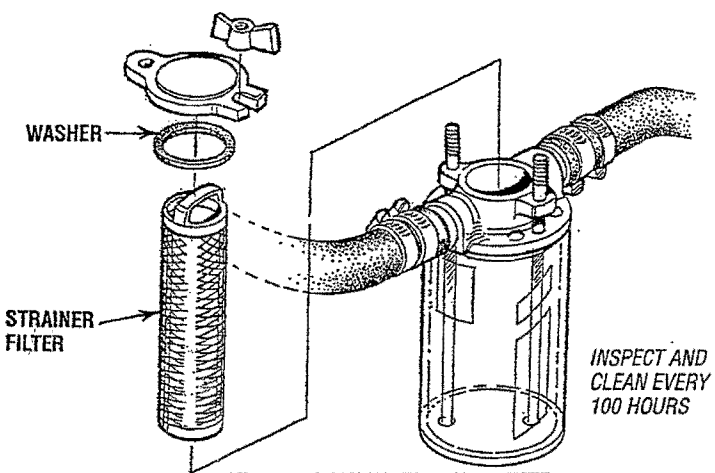
A clean raw water intake strainer is a vital component of the engine's cooling system. Include a visual inspection of this strainer when making your periodic engine check. The water in the glass should be clear.

Perform the following maintenance after every 100 hours of operation:

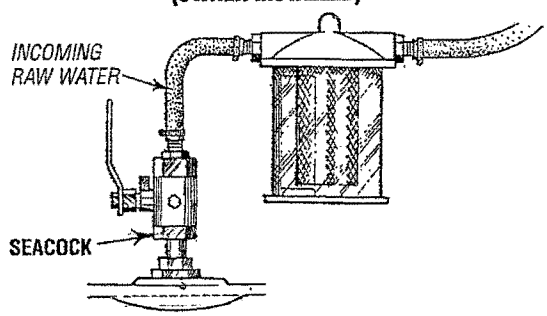
1. **Close the raw water seacock.**
2. Remove and clean the strainer filter.
3. Clean the glass.
4. Replace the washer if necessary.
5. Reassemble and install the strainer.
6. **Open the seacock.**
7. Run the engine and check for leaks.

NOTE: *Also follow the above procedure after having run hard aground.*

If the engine temperature gauge ever shows a higher than normal reading, the cause may be that silt, leaves or grass may have been caught up in the strainer, slowing the flow of raw water through the cooling system.



TYPICAL RAW WATER STRAINER (OWNER INSTALLED)



COOLING SYSTEM

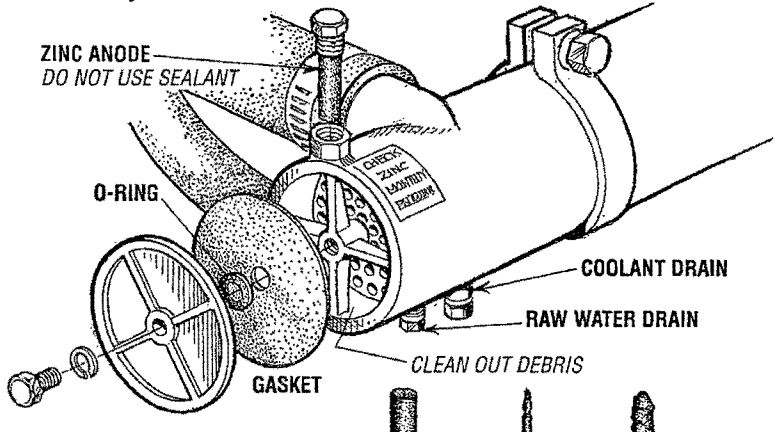
RAW WATER COOLING CIRCUIT

The raw water flow is created by a positive displacement impeller pump. This pump draws water directly from the ocean, lake, or river from a thru-hull opening through a hose to the water strainer. The raw water passes from the strainer through the pump to the heat exchanger (through the heat exchanger tubes) where it cools the engine's circulating fresh water coolant. The raw water is then discharged into the water-injected exhaust elbow, mixing with, and cooling the exhaust gasses. This mixture of exhaust gas and raw water is driven through the stern tube and overboard.

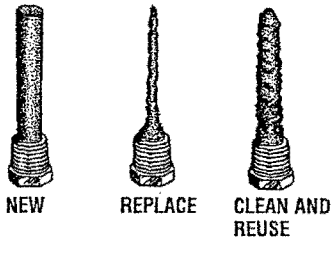
HEAT EXCHANGER

Cool raw water flows through the inner tubes of the heat exchanger. As the engine coolant passes around these tubes, the heat of the internal engine is conducted to the raw water which is then pumped into the exhaust system and discharged. The engine coolant (now cooled) flows back through the engine and the circuit repeats itself.

NOTE: *Operating in silty and/or tropical waters may require that a heat exchanger cleaning be performed more often then every 1000 hours.*



HEAT EXCHANGER
CLEAN OUT BOTH ENDS



ZINC ANODE

A zinc anode, or pencil, is located in the raw water cooling circuit within the heat exchanger. The purpose of the zinc anode is to sacrifice itself to electrolysis action taking place in the raw water cooling circuit, thereby reducing the effects of electrolysis on other components of the system. The condition of the zinc anode should be checked monthly and the anode cleaned or replaced as required. Spare anodes should be carried on board.

NOTE: *Electrolysis is the result of each particular installation and vessel location; not that of the engine.*

NOTE: *The threads of the zinc anodes are pipe threads and do not require sealant. Sealant should not be used as it may insulate the zinc from the metal of the heat exchanger housing preventing electrolysis action on the zinc.*

RAW WATER PUMP

The raw water pump is a self-priming, rotary pump with a non-ferrous housing and a Neoprene impeller. The impeller has flexible blades which wipe against a curved cam plate within the impeller housing, producing the pumping action. **On no account should this pump be run dry.** There should always be a spare impeller and impeller cover gasket aboard (an impeller kit). Raw water pump impeller failures occur when lubricant (raw water) is not present during engine operation. Such failures are not warrantable, and operators are cautioned to make sure raw water flow is present at start-up. The raw water pump should be inspected periodically for broken or torn impeller blades. See *MAINTENANCE SCHEDULE.*

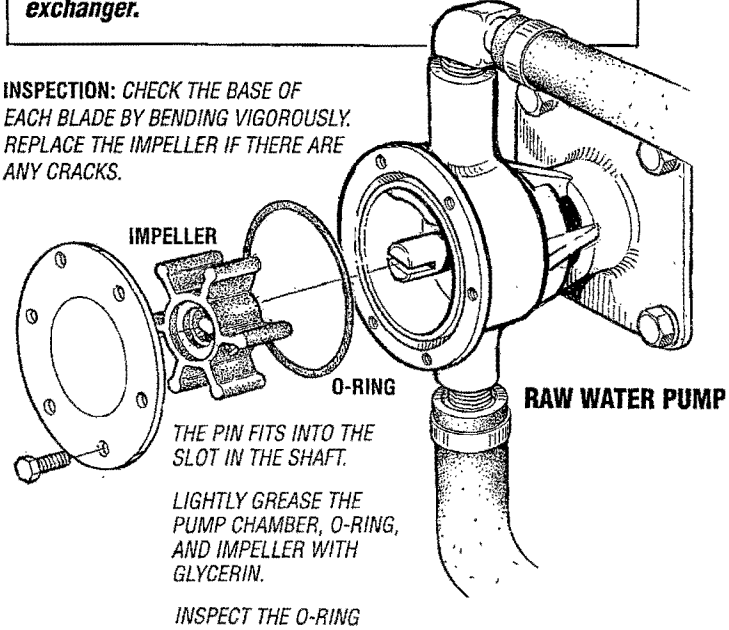
NOTE: *Should a failure occur with the pumps internal parts (seals and bearings), it may be more cost efficient to purchase a new pump and rebuild the original pump as a spare.*

Changing the Raw Water Pump Impeller

Close the raw water intake valve. Remove the pump cover and, using an impeller puller, screw drivers, or pliers, carefully pry the impeller out of the pump. Install the new impeller and gasket. Move the blades to conform to the curved cam plate and push the impeller into the pumps housing. When assembling, apply a thin coating of lubricant to the impeller and gasket. Open the raw water intake valve.

> ⚠ **CAUTION:** ***If any of the vanes have broken off the impeller, they must be found to prevent blockage in the cooling circuit. They often can be found in the heat exchanger.***

INSPECTION: *CHECK THE BASE OF EACH BLADE BY BENDING VIGOROUSLY. REPLACE THE IMPELLER IF THERE ARE ANY CRACKS.*



THE PIN FITS INTO THE SLOT IN THE SHAFT.

LIGHTLY GREASE THE PUMP CHAMBER, O-RING, AND IMPELLER WITH GLYCERIN.

INSPECT THE O-RING AND IMPELLER. REPLACE IF THEY SHOW SIGNS OF WEAR.

ENGINE LUBRICATING OIL

ENGINE OIL CHANGE

1. ***Draining the Oil Sump.*** Discharge the used oil through the sump drain hose (attached to the front of the engine) while the engine is warm. Drain the used oil completely, replace the hose in its bracket, and replace the end cap securely.

   NOTE: *Thread size for the lube oil drain hose capped end is 1/4 NPT.*

   Always observe the used oil as it is removed. A yellow/gray emulsion indicates the presence of water in the oil. Although this condition is rare, it does require prompt attention to prevent serious damage. Call a qualified mechanic should water be present in the oil. Raw water present in the oil can be the result of a fault in the exhaust system attached to the engine and/or a siphoning of raw water through the raw water cooling circuit into the exhaust, filling the engine. This problem is often caused by the absence of an anti-siphon valve, its poor location or lack of maintenance.

2. ***Replacing the Oil Filter.*** When removing the used oil filter, you may find it helpful and cleaner to punch a hole in the upper and lower portion of the old filter to drain the oil from it into a container before removing it. This helps to lessen spillage. A small automotive filter wrench should be helpful in removing the old oil filter.

   NOTE: *Do not punch this hole without first loosening the filter to make certain it can be removed.*

   Place some paper towels and a plastic bag around the filter when unscrewing it to catch any oil left in the filter. (Oil or any other fluid on the engine reduces the engine's cooling ability. Keep your engine clean.) Inspect the old oil filter as it is removed to make sure that the rubber sealing gasket comes off with the old oil filter. If this rubber sealing gasket remains sealed against the filter bracket, gently remove it.

   When installing the new oil filter element, wipe the filter gasket's sealing surface on the bracket free of oil and apply a thin coat of clean engine oil to the rubber gasket on the new oil filter. Screw the filter onto the threaded oil filter nipple on the oil filter bracket, and then tighten the filter firmly by hand.

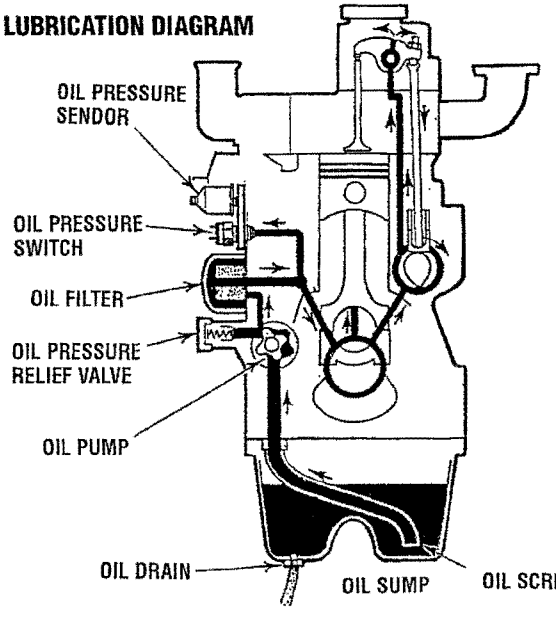
   NOTE: *The engine oil is cooled by engine coolant flowing through passages in the oil filter bracket housing assembly.*

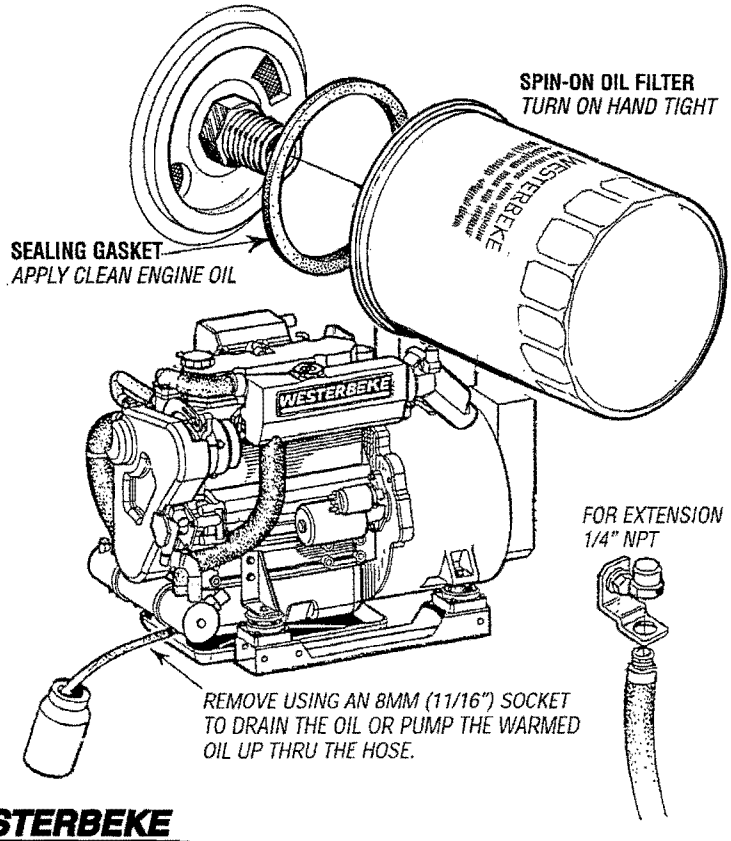
> ⚠ **WARNING:** ***Used engine oil contains harmful contaminants. Avoid prolonged skin contact. Clean skin and nails thoroughly using soap and water. Launder or discard clothing or rags containing used oil. Discard used oil properly.***

   NOTE: *Generic filters are not recommended, as the material standards or diameters of important items on generic parts might be entirely different from genuine parts. Immediately after an oil filter change and oil fill, run the engine to make sure the oil pressure is normal and that there are no oil leaks around the new oil filter.*

3. ***Filling the Oil Sump.*** Add new oil through the oil filler cap on the top of the engine or through the side oil fill. After refilling, run the engine for a few moments while checking the oil pressure. Make sure there is no leakage around the new oil filter or from the oil drain system, and stop the engine. Then check the quantity of oil with the lube oil dipstick. Fill to, but not over the high mark on the dipstick, should the engine require additional oil.

LUBRICATION DIAGRAM





REMOTE OIL FILTER (OPTIONAL)

REMOTE OIL FILTER KIT PN#040078

INSTALLATION

This popular accessory is used to relocate the engine's oil filter from the engine to a more convenient location such as an engine room bulkhead.

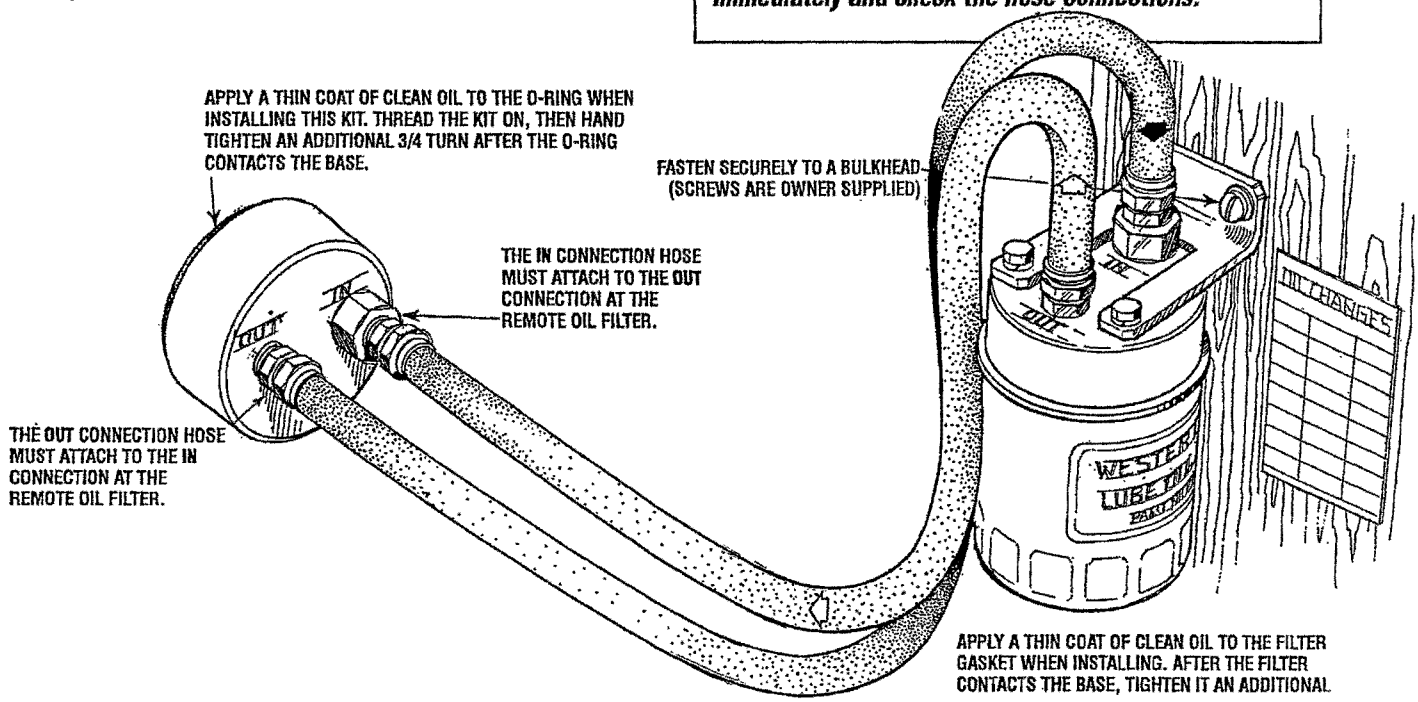
NOTE: *Refer to ENGINE OIL CHANGE in this manual for instructions on removing the oil filter.*

To install, simply remove the engine oil filter and thread on WESTERBEKE's remote oil filter kit as shown. Always install this kit with the oil filter facing down as illustrated.

Contact your WESTERBEKE dealer for more information.

NOTE: *Westerbeke is not responsible for engine failure due to incorrect installation of the Remote Oil Filter.*

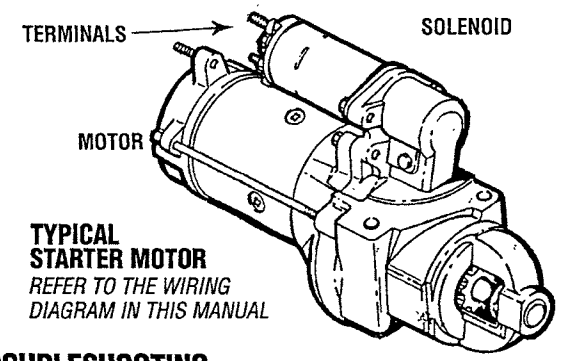
⚠ CAUTION: ***It is vital to install the oil lines correctly. If the oil flows in the reverse direction, the bypass valve in the filter assembly will prevent the oil from reaching the engine causing an internal engine failure. If there is no oil pressure reading, shutdown immediately and check the hose connections.***


APPLY A THIN COAT OF CLEAN OIL TO THE O-RING WHEN INSTALLING THIS KIT. THREAD THE KIT ON, THEN HAND TIGHTEN AN ADDITIONAL 3/4 TURN AFTER THE O-RING CONTACTS THE BASE.
FASTEN SECURELY TO A BULKHEAD (SCREWS ARE OWNER SUPPLIED)
THE IN CONNECTION HOSE MUST ATTACH TO THE OUT CONNECTION AT THE REMOTE OIL FILTER.
THE OUT CONNECTION HOSE MUST ATTACH TO THE IN CONNECTION AT THE REMOTE OIL FILTER.
OIL CHANGES
APPLY A THIN COAT OF CLEAN OIL TO THE FILTER GASKET WHEN INSTALLING. AFTER THE FILTER CONTACTS THE BASE, TIGHTEN IT AN ADDITIONAL

STARTER MOTOR

DESCRIPTION

The starter is a new type, small, light-weight and is called a high-speed internal-reduction starter. The pinion shaft is separate from the motor shaft; the pinion slides only on the pinion shaft. A reduction gear is installed between the motor shaft and a pinion shaft. The pinion sliding part is not exposed outside the starter so that the pinion may slide smoothly without becoming fouled with dust and grease. The motor shaft is supported at both ends on ball bearings. The lever mechanism, switch and overrunning clutch inner circuit are identical to conventional ones.



TYPICAL STARTER MOTOR
REFER TO THE WIRING DIAGRAM IN THIS MANUAL

TROUBLESHOOTING

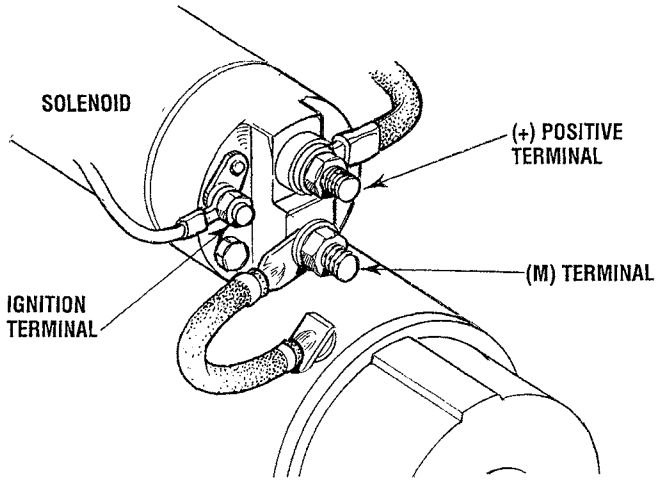
> ⚠ **WARNING:** ***The following emergency starting procedures must not be used with gasoline engines. Sparks could cause an explosion and fire.***

Prior to testing, make certain the ships batteries are at full charge and that the starting system wiring connections (terminals) are clean and tight. Pay particular attention to the ground wire connections on the engine block.

To check the wiring, try cranking the starter for a few seconds, never more than 10 seconds at a time, then run your hand along the wires and terminals looking for warm spots that indicate resistance. Repair or replace any trouble spots.

Using a multimeter, test the voltage between the positive terminal stud on the start solenoid and the engine block (ground).

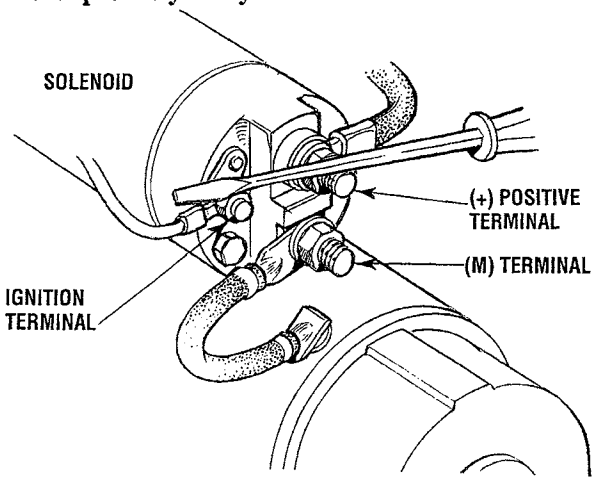
If you read 12 volts, the starter is faulty.



To test the ignition circuit, locate the ignition(s) terminal (it is one of the small terminal studs and is wired to the ignition circuit). Use a screwdriver, don't touch the blade, to jump from that ignition terminal to the positive battery connection terminal on the solenoid.

If the starter cranks, the fault lies with the ignition circuit.

If the solenoid clicks but nothing happens, the starter motor is probably faulty.

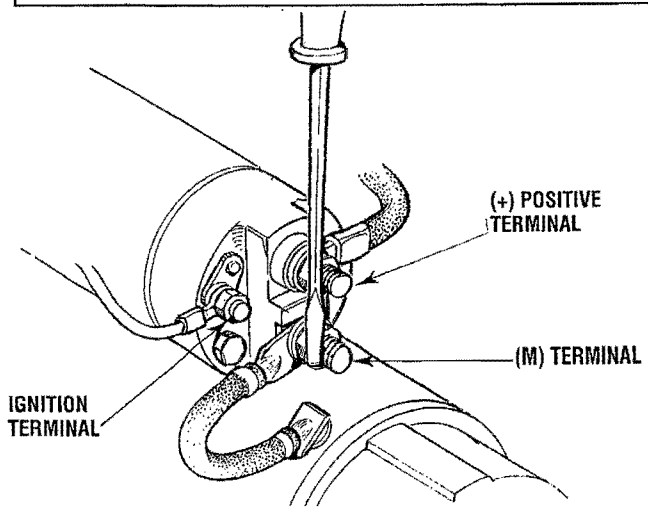


If nothing happens at all, the solenoid is not getting current.. Check the battery isolation switch and inspect the wiring connections. it is also possible that the solenoid is defective.

> ⚠ **WARNING:** ***There will be arching and sparks will fly when jumping terminals. Be certain the engine space is free of potentially explosive fumes, especially gasoline, and that there are NO flammable solvents or materials stored nearby.***

STARTER MOTOR

> ⚠ **WARNING:** ***When performing these procedures, position yourself safely away from the moving parts of the engine in case the engine starts-up. Also warn other crew members of the danger.***



Test again by jumping the two large terminal studs. Hold the screwdriver blade firmly between the studs. Do not allow the screwdriver blade to touch the solenoid or starter casing, this would cause a short.

> ⚠ **WARNING:** ***There will be arching as the full starting current should be flowing thru the blade of the screwdriver.***

If the starter spins, the solenoid is faulty.

If the starter fails to spin, the motor is probably faulty.

If no arching occurred, there is no juice reaching the solenoid.

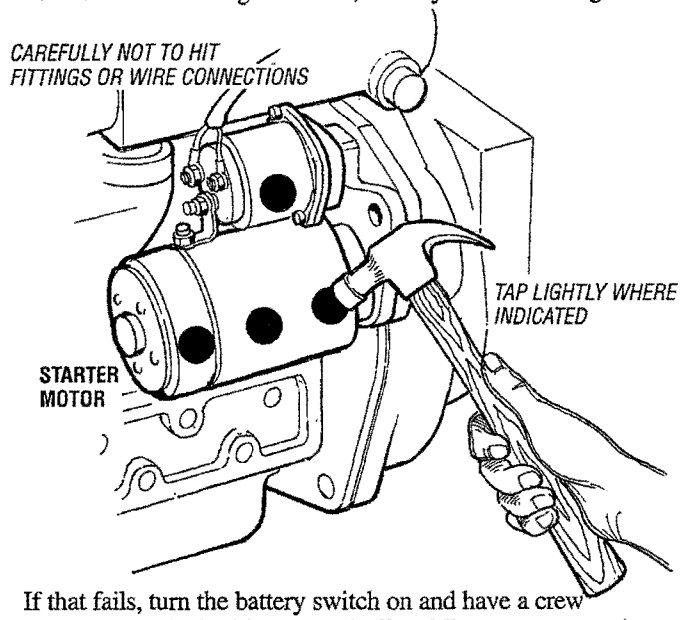
NOTE: *Starter motors are either inertia type or pre-engaged. In the pre-engaged model, the solenoid also moves an arm that engages the starter motor to the flywheel of the engine. using a screwdriver to bypass the solenoid on such a starter will run the motor without engaging the flywheel. Turn the starter switch on to provide power to the solenoid. Hopefully it will create enough magnetic field for the arm to move even though the contacts inside the solenoid are bad.*

EMERGENCY START

Corrosion to the starter brushes and/or the solenoid contacts can cause the sporadic problem of the engine starting one time but not another. If corrosion is the problem, the starter will need to be rebuilt.

It is however, sometimes possible to get started by taping the starter lightly with a small hammer.

With the battery switch off and no ignition,. tap lightly on the starter/solenoid casing as shown, then try to start the engine.



If that fails, turn the battery switch on and have a crew member turn the ignition on and off rapidly as you tap again with the hammer., This may loosen the brushes and allow contact to start the engine. When you reach a repair facility, the starter will need to be repaired.

SERVICE

WESTERBEKE uses a standard starter motor which can be serviced or rebuilt at any starter motor automotive service center,

If replacing the starter motor, make certain the new motor is certified for marine use. Automotive starters do not meet USCG standards. If in doubt, contact your WESTERBEKE dealer.

TO REMOVE FOR SERVICE

1. Disconnect the negative battery cable.
2. If necessary, remove any components to gain full access to the starter motor.
3. Label and disconnect the wiring from the starter. (Do not allow wires to touch, tape over the terminals).
4. Remove the starter mounting bolts.
5. Remove the starter from the engine. In some cases the starter will have to be turned to a different angle to clear obstructions,

SPECIFICATIONS - 7.6KW ETD GENERATOR

ENGINE SPECIFICATIONS

Engine Type	Diesel, four-cycle, three-cylinder, fresh water-cooled, vertical in-line overhead valve mechanism (11 Hp at 1800 rpm maximum)
Aspiration	Naturally aspirated
Governor	Electronic
Combustion Chamber	Swirl type
Bore & Stroke	2.99 x 2.76 inches (76 x 70 mm)
Piston Displacement	59.09 cubic inches (0.952 liters)
Firing Order	1 - 3 - 2
Direction of Rotation	Clockwise, when viewed from the front
Compression Ratio	21:1
Dimensions	Height: 20.4 inches (518.6 mm) Width: 19.0 inches (482.6 mm) Length: 27.6 inches (518.6 mm)
Weight	407 lbs (184.6 kgs)
Fuel Consumption	0.53 gph (2 lph) at full rated load
Inclination	Continuous 15° Temporary 25° (not to exceed 30 min.)
Generator Power Take Off	11/9 hp (maximum)

TUNE-UP SPECIFICATIONS

Compression Pressure (Limit of Difference Between cylinders)	398 psi (28 kg/cm²) at 280 rpm limit 47.2 psi (3.0 kg/cm²)
Valve Timing	Intake Opens 17° BTDC Intake Closes 47° ABDC Exhaust Opens 51° BBDC Exhaust Closes 13° ATDC
Spill timing (Static)	15° ± .5
Valve Seat Angle	Intake 45° Exhaust 45°
Engine Speed	1800 rpm 60 Hertz 1500 rpm 50 Hertz
Valve Clearance (engine cold)	Intake and Exhaust 0.010 inches (0.25 mm)
Injector Pressure	1920 + 71 - 0 psi (135 + 5 - 0 kg/cm²)

FUEL SYSTEM

General	Open flow, self bleeding - self priming
Fuel	No. 2 diesel oil (cetane rating of 45 or higher)
Fuel Injection Pump	In-line plunger (Bosch type)
Fuel Injection Timing (spill timing)	15° ± .5 BTDC
Nozzle	Throttle type
Fuel Filter	Spin-on type
Air cleaner	Plastic intake silencer
Air Flow (engine combustion)	30.2 cfm (0.85 cmm)

EXHAUST EMISSIONS SYSTEMS

Emission Control Systems	Smoke puffer limiter

ELECTRICAL SYSTEM

Starting Battery	12-Volt, (-) negative ground
Battery Capacity	800-1000 Cold Cranking Amps (CCA)
DC Charging Alternator	51 Amp rated, belt driven
Starter	12-Volt, reduction gear, 1.2 KW
Starting Aid	Glow plugs, sheathed type
DC No-Load Current	± 2% of rated amps
DC Cranking Current	195 - 200 Amps (engine cold)

COOLING SYSTEM

General	Fresh water-cooled block, thermostatically-controlled with heat exchanger
Operating Temperature	170 - 190° F (77 - 88° C)
Fresh Water Pump	Centrifugal type, metal impeller, belt-driven
Raw Water Pump	Positive displacement, rubber impeller, gear-driven
Raw Water Flow, at 1800 rpm	6.5 US gpm (25.8 lpm) (measured before discharging into exhaust elbow).
System Capacity (fresh water)	4.0 qts (3.79 liters)

LUBRICATION SYSTEM

General	Pressure fed system with external relief valve
Oil Filter	Full flow, paper element, spin-on type
Sump Capacity (not including filter)	3.2 U.S. qts (3.03 liters) plus filter/cooler assembly
Operating Oil Pressure (engine hot)	35 - 55 psi (2.5 - 3.8 kg/cm²)
Oil Grade	API Specification CF, CG-4, CH-4 Or CI-4 SAE 30, 10W-30, 15W-40

AC GENERATOR (Single Phase)

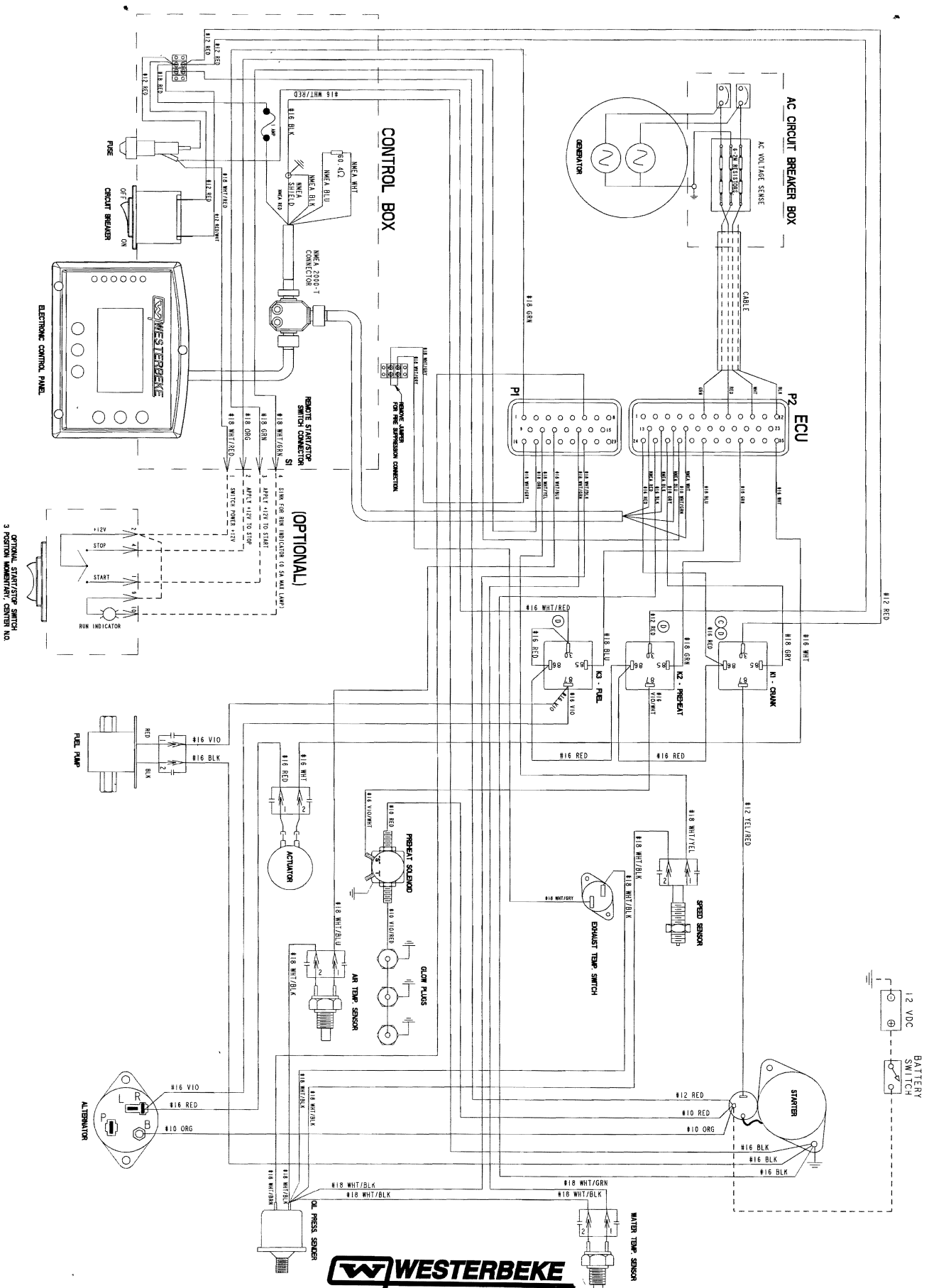
General - Single Phase	Brushless, four-pole, revolving field sealed lubricated single bearing design. Reconnectable single phase for 120/240 volts with solid state voltage regulator.
Voltage - Single Phase	120 or 120/240 Volts - 60 Hertz 230 Volts - 50 Hertz.
Voltage regulation:	±5% no load to full load.
Frequency regulation:	±0.05 Hertz (5%) no load to full load.
Rating (Volts AC)	**7.6 KW** - 60 Hertz (1800 rpm) 120 Volts - 31.6 Amps 120/240 Volts - 63.1/31.6 Amps **5.7 KW** - 50 Hertz (1500 rpm) 230 Volts - 24.7 Amps

AC GENERATOR (Single Phase)

Air Requirements (60 Hertz) at 1800 rpm	200 cfm (5.66 cmm)
NOTE: *Increase air supply 15% for 50 Hertz operation @ 1500 rpm*	
Engine Combustion	30.2 cfm (0.85 cmm)
Generator Compartment Temperature	120°F (50°C) maximum
Compartment Cooling	100 cfm (2.8 cmm)

ECO NO	DATE	REV	REVISION RECORD	AUTH	DR BY
6217	6-12 2006	A	RELEASE TO SYSTEM		GA
6289	11-28 2006	B	ADDED 1 AMP FUSE, FIRE SUPPRESSION SYSTEM AND TERMINAL STRIPS TO THE WIRING DIAGRAM ADDED OPTOINAL REMOTE S/S CONNECTION		GA
6297	1-5 2007	C	P2-PIN 24 WAS CONNECTED TO K1-PIN 86.		GA
6309	1-31 2007	D	REROUTE K1-30 (16-RED) TO K1-86. REMOVE JUMPER WIRE (16-RED) BETWEEN K2-30 AND K3-30. REROUTE K3-86 (16-WHT/RED) TO K3-30 ADD JUMPER WIRE (16-RED) BETWEEN K3-30 AND K3-86. REROUTE K3-30 (12-RED) TO K2-30.		GA

7.6KW ETD WIRING DIAGRAM #52414



ENGINE ADJUSTMENTS

NOTE: *WESTERBEKE recommends that the following engine adjustments be performed by a competent engine mechanic. The information below is provived to assist the mechanic.*

DRIVE BELT ADJUSTMENT

For your safety, WESTERBEKE generator models come equipped with belt guards that cover over the belt(s) on the front of the engine. ("Out of sight - out of mind." The belt guard is NOT installed for that purpose.) Operators are advised that proper inspection, service, and maintenance is required.

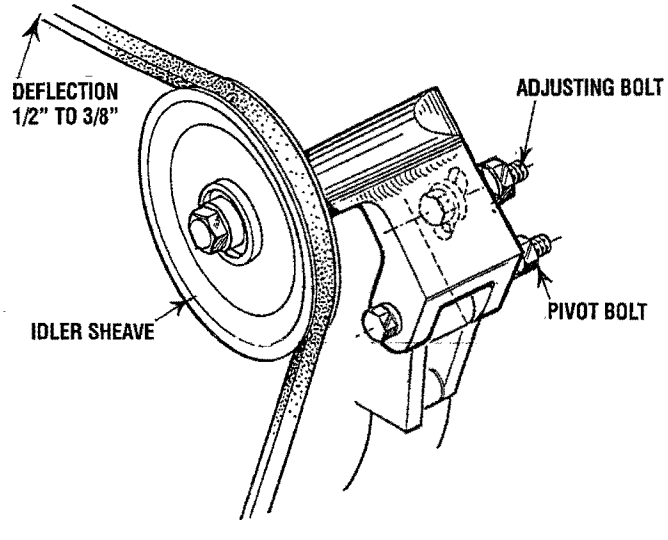
Excessive drive belt tension can cause rapid wear of the belt and reduce the service life of the fresh water pump's bearing. A slack belt or the presence of oil on the belt can cause belt slipping, resulting in high operating temperatures.

The drive belt is properly adjusted if the belt can be deflected no less than 3/8 inch (10mm) and no more than 1/2 inch (12mm) as the belt is depressed with the thumb at the midpoint between the two pulleys on the longest span of the belt. A spare belt or belts should always be carried on board.

> ⚠ **WARNING:** ***Never attempt to check or adjust the drive belt's tension while the engine is in operation.***

Adjusting Belt Tension

1. Remove the belt guard.
2. Loosen the pivot belt that holds the idler sheave and loosen the adjusting bolt.
3. With the belt loose, inspect for wear, cracks and frayed edges.
4. Pivot the idler sheave to the left or right as required, to loosen or tighten.
5. Tighten the pivot bolt and the adjusting bolt.
6. Replace the guard. Operate the generator for about 5 minutes and then shut the generator down.
7. Remove the guard and recheck the belt tension.
8. Replace the guard.

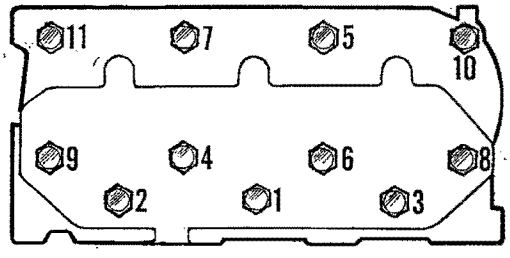


TORQUING THE CYLINDER HEAD BOLTS

After the initial break-in period (approximately 50 hours) and every 500 hours thereafter, the cylinder head bolts should be re-torqued.

Tighten the cylinder head bolts according to the sequence shown. Make sure the engine is cold when this is done. Before applying the specified torque to the bolt, loosen it 1/4 to 1/2 of a turn and then apply the torque. Follow this procedure according to the numbered sequence shown in the illustration to the right.

Bolts **#1, 2,** and **3,** (12mm socket) 14 – 22 ft-lb
Bolts **#4, 5, 6, 7, 8,** (14mm socket) (54 -- 61 ft-lb)
Rockershaft Hold Down Bolts - 12mm socket (11 ~ 16 ft-lb).



CYLINDER HEAD BOLT PATTERN

FUEL INJECTORS

In case of severe vibrations and detonation noise, have the injectors checked and overhauled by an authorized fuel injection service center. Poor fuel quality, contaminant's and loss of positive fuel pressure to the injection pump can result in injector faults. Since fuel injectors must be serviced in a clean room environment, it is best to carry at least one extra injector as a spare should a problem occur.

Before removing the old injector, clean the area around the base of the injector to help prevent any rust or debris from falling down into the injector hole. If the injector will not lift out easily and is held in by carbon build-up or the like, work the injector side-to-side with the aid of the socket wrench to free it, and then lift it out.

The injector seats in the cylinder head on a copper sealing washer. This washer should be removed with the injector and replaced with a new washer when the new injector is installed.

START TO INJECTION PRESSURE
1988 ± 142PSI (140 ± 10KG/CM²)

NOTE: *Refer to the fuel injector page in this manual for additional information.*

ENGINE ADJUSTMENTS

GENERATOR FREQUENCY ADJUSTMENT (HERTZ)

Once the diesel generator set has been placed in operation, there may be adjustments required for engine speed (Hertz) during the engine's break-in period (first 50 hours) or after this period. A no-load voltage adjustment may also be required in conjunction with the engine's speed adjustment. These are not warrantable adjustments as they relate to normal break-in and maintenance.

Frequency is a direct result of engine/generator speed, as indicated by the following:

When the generator is run at 1800 rpm, the AC voltage output frequency is 60 Hertz.

When the generator is run at 1500 rpm, the AC voltage output frequency is 50 Hertz.

Therefore to change the generator's frequency, the engine speed *must* be changed. To accomplish the frequency change, perform the following:

1. With the engine stopped, connect the AC output leads to the AC terminal block in accordance with the AC voltage connections diagram specified for your generator set, and change the Hertz circuit connection to the capacitor. These connections are shown in the GENERATOR section of this manual.

> ⚠ **WARNING:** ***Before starting the engine make certain that everyone is clear of moving parts! Keep away from pulleys and belts during test procedures.***

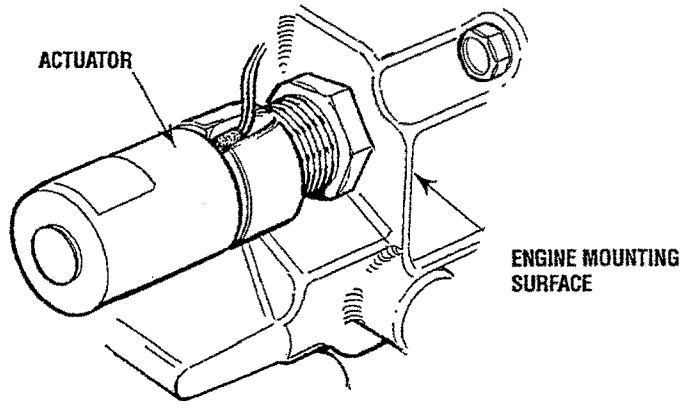
2. In the control box on the generator is located the Electronic Control Unit (ECU). Switch #1 contols engine speed/generator frequency. **ON** for 50 Hz and **OFF** for 60 Hz. Select the correct switch position for the desired operating hertz.

3. Start the engine and observe generator hertz and no load AC voltage output. Adjust no load AC out put as needed. Refer to page 38 of this manual.

*WHEN CHANGING THE GENERATORS FREQUENCY (50/60 HZ) SWITCH #1 ON THE CONTROL PANEL ECU BOARD MUST BE SWITCHED: **ON** FOR 50 HZ AND **OFF** FOR 60 HZ.*

ELECTRONIC GOVERNOR

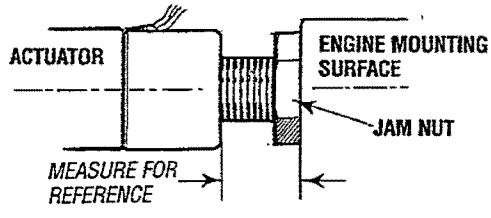
The Electronic Governor regulates the engine speed by sensing the engine's RPM with a magnetic pick-up at the flywheel. The governor's controller continuously monitors the engines speed and if there is any discrepancy, the controller signals the actuator and the actuator adjusts the engine to the desired speed electronically.



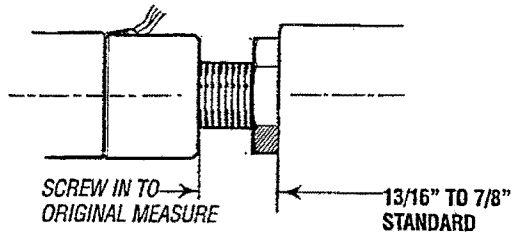
Actuator

The following instructions are for adjusting or replacing the actuator.

1. Shut-off the DC power to the generator.
2. Disconnect the actuator wires from the wiring harness.
3. Measure the distance between the actuator and the engine mounting surface as shown.



4. Back-off the 1 7/16" jam nut and unscrew the actuator.
5. Apply a small amount of teflon sealant to the replacement actuator and screw the actuator into the engine's mounting boss. Maintain the same distance between the actuator and the engine mounting surface as previously measured Secure the actuator's position with the jam nut. (The standard distance is 13/16" to 7/8").
6. Reconnect the actuator wires and test the unit.



NOTE: *For additional information and Electronic Governor Troubleshooting, refer to your WESTERBEKE Service Manual.*

ENGINE ADJUSTMENTS

VALVE CLEARANCE ADJUSTMENT

NOTE: *Retorque the cylinder head bolts before adjusting the engine's valves. See* TORQUING THE CYLINDER HEAD BOLTS.

> ⚠ **WARNING:** ***Adjust the valve clearance when the engine is cold. Valves are adjusted by cylinder in the firing order of the engine. Tighten the cylinder head bolts to the specified torque before adjusting the valves.***

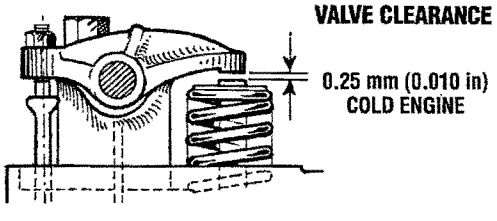
Pull off the air breather pipe from the rocker cover and take off the rocker cover bolts and the rocker cover to expose the rocker shaft and valve assembly.

Remove the glow plugs from each of the cylinders to enable the crankshaft to be easily rotated by hand to position each cylinder for valve adjustment.

Valves are adjusted with the cylinder in the piston being adjusted at Top Dead Center (TDC) of its compression stroke. Each cylinder is adjusted following the engine's firing order (1-3-2 for WESTERBEKE three cylinder engines).

Valve adjustment beginning with cylinder #1. Rotate the crankshaft slowly and observe the operation of the valves for cylinder #1. Watch for the intake valve to open indicating the piston is on it's intake stroke (the piston is moving down in the cylinder). Continue to rotate the crankshaft slowly and look for the intake valve to close. This indicates the piston is now starting it's compression stroke (the piston is moving up in the cylinder towards TDC).

Align the TDC mark on the crankshaft front pulley with the timing marker on the front gear case cover when positioning the #1 Piston at TDC of it's compression stroke. Confirm this by rotating the crankshaft approximately 20 degrees before and after this point and the two valves for the #1 cylinder should not move.



Adjust the valves in #1 cylinder for both intake and exhaust.

Proceed to the next cylinder in the firing order.

Rotate the crankshaft 240 degrees in the normal direction of rotation and adjust the next cylinder's valves in the firing order. Rotate the crankshaft another 240 degrees and adjust the valves of the next cylinder in the firing order.

Adjust each valve's clearance by inserting a 0.010in (0.25mm) feeler gauge between the rocker arm and the valve stem. Make sure to adjust all valves while the engine is cold.

Re-install the glow plugs (use anti-seize compound on the threads) and assemble the rocker cover and rocker cover bolts. See TIGHTENING TORQUE SCHEDULE in this manual.

ENGINE COMPRESSION

Check the compression pressure. To do this warm the engine, remove all fuel injectors, or glow plugs, disconnect the fuel shut-off solenoid wire, and install a compression adapter in the injector hole or glow plug hole. Connect a compression tester on the adapter and crank the engine with the starter motor until the pressure reaches a maximum value. Repeat this process for each cylinder. Look for cylinders with dramatically (at least 20%) lower compression than the average of the others. Compression pressure should not differ by more than 35.5 psi (2.5 kg/cm²) at 280 rpm.

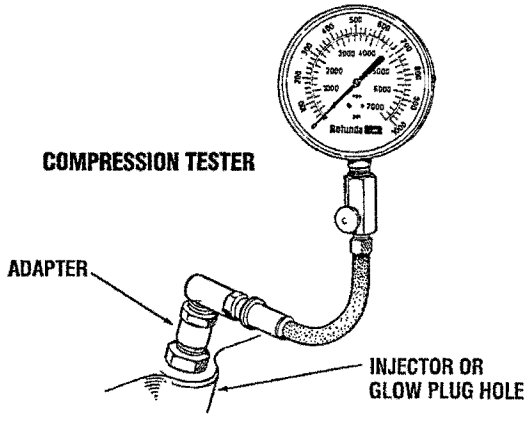
Standard compression pressure 398 lb/in² at 280 rpm (28.0 kg/cm²)

If a weak cylinder is flanked by healthy cylinder, the problem is either valve or piston related. Check the valve clearances for the weak cylinder, adjust as needed and test again. If the cylinder is still low, apply a small amount of oil into the cylinder to seal the rings and repeat the test. If compression comes up - the rings are faulty.

Abnormally high readings on all cylinders indicates heavy carbon accumulations, a condition that might be accompanied by high pressures and noise.

NOTE: *In case of severe vibrations and detonation noise, the cause may be fuel injector problems, see* FUEL INJECTORS. *Poor fuel quality, contaminates and loss of positive fuel pressure to the injection pump will result in injector faults.*

When re-installing the glow plugs use anti-seize compound.



ENGINE ADJUSTMENTS

NOTE: *WESTERBEKE recommends that the following engine adjustments be performed by a competent engine mechanic. The information below is provided to assist the mechanic.*

Injection Pump Timing Adjustment (Spill Timing)

If your engine's fuel injection timing is not properly adjusted, the engine will not operate properly, and may be difficult to start. Have the injection pump delivery rate checked by a well-established fuel injection shop. Adjust the injection as follows:

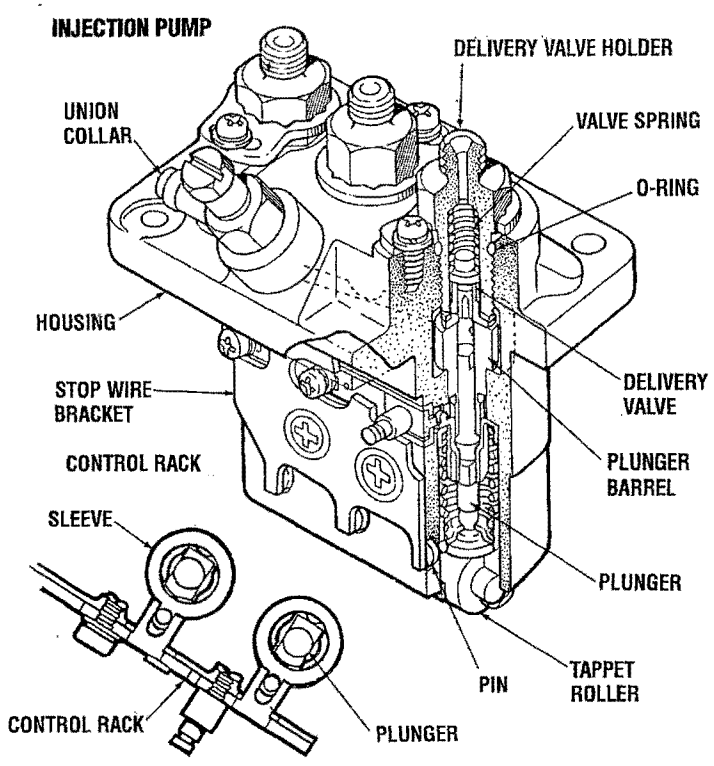
NOTE: *The injection pump fuel rack needs to be in the full fuel delivery position when performing this spill timing. To do this, unscrew the fuel shut off solenoid and remove the side cover to expose the injection pump fuel rack. Manually move the fuel rack to the full fuel delivery position (move fully to the left) secure it in this position then proceed.*

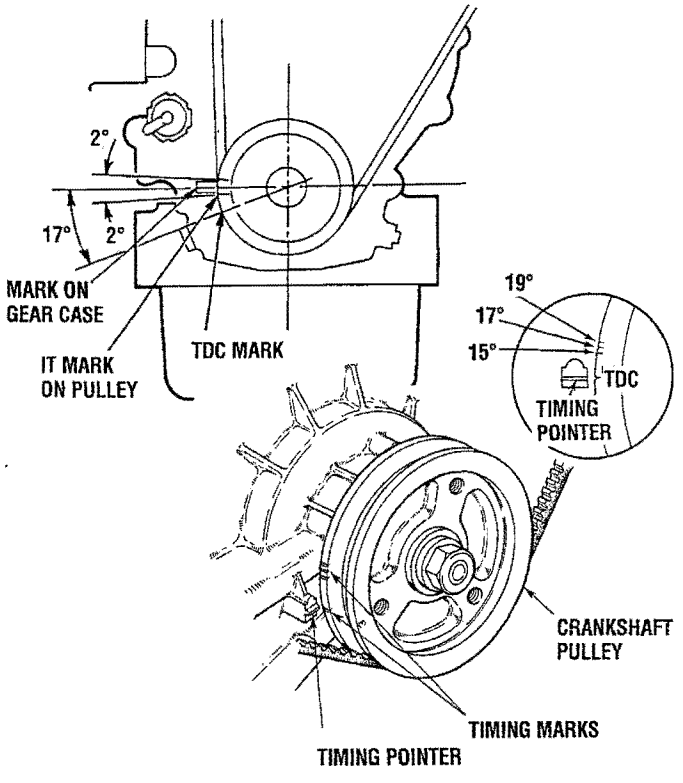
1. Remove the high pressure fuel line from between the No. 1 injector and the No. 1 fuel delivery valve holder.
2. Remove the No. 1 fuel delivery valve holder over "O" ring and remove the delivery valve spring beneath the holder.
3. Reinstall only the delivery valve holder and reattach the high pressure fuel line to the delivery holder. Attach it so that the end that would connect to the fuel injector is pointing away from the engine fuel will flow from this line during the timing check.

Rotate the engine's crankshaft in its normal direction of rotation to position piston No. 1 at the beginning of its compression stroke.

Move the throttle lever to its full open position and operate the electric lift pump. Slowly rotate the crankshaft clockwise (as viewed from the front), catching the fuel from the No. 1 fuel line, until the instant the fuel completely stops flowing (no drips). At this instant, the 15° BTDC timing mark on the crankshaft pulley should be directly aligned with the timing indicator on the front of the gear case ± .5 degrees.

If the specified injection timing (15° BTDC) cannot be attained, adjust the timing by increasing or decreasing the thickness of shim material under the injection pump's mounting flange to change the injection timing point. Changing the shim thickness by 0.004 inch (0.01mm) changes the injection timing by approximately one degree. To advance the timing, decrease the shim thickness, as required. To retard the timing, increase the shim thickness, as required. Refer to your Generator's Parts List for shim part numbers.





ENGINE ADJUSTMENTS

NOTE: *WESTERBEKE recommends that the following engine adjustments be performed by a competent engine mechanic. The information below is provided to assist the mechanic.*

OIL PRESSURE

The engine's oil pressure,is constantly monitored by the control panel. The red light will illuminate and the generator will shutdown if the oil pressure fall below 5 psi. Do not restart the generator without checking the oil and finding the problem.

NOTE: *A newly started, cold engine can have an oil pressure reading upwards of 60 psi. A warmed engine can have an oil pressure reading as low as 35 psi. These readings will vary depending upon the temperature of the engine and the load placed on the generator.*

LOW OIL PRESSURE

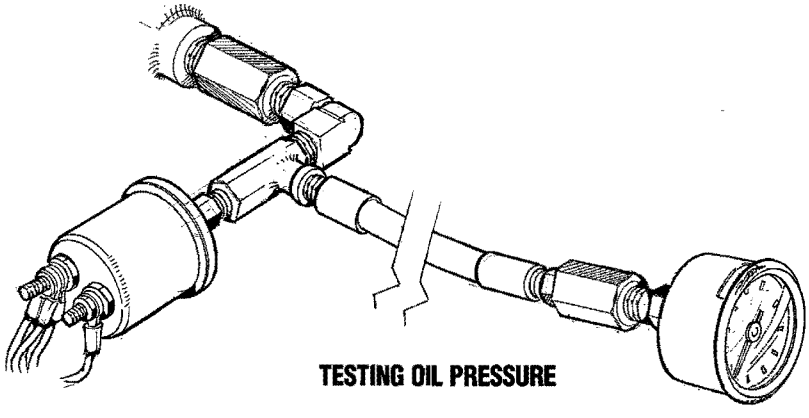
The specified safe minimum oil pressure is 4.3 - 1.4 psi(0.3 - 0.1 kg/cm^2). An oil pressure of 5 PSI will shut the engine down. A gradual loss of oil pressure usually indicates worn bearings. For additional information on low oil pressure readings, see the *ENGINE TROUBLESHOOTING* chart.

TESTING OIL PRESSURE

To test oil pressure, remove the oil gallery "T" plug and install a mechanical oil pressure gauge in its place. After warming up the engine, read the oil pressure gauge.

OIL PRESSURE **35.0 lb/in^2 (3.8 kg/cm^2) or more at 1800 rpm (depending on temperature and load)**

SENSOR & GAUGE **9 - 13 ft-lb (1.2 - 1.8 m-kg)**



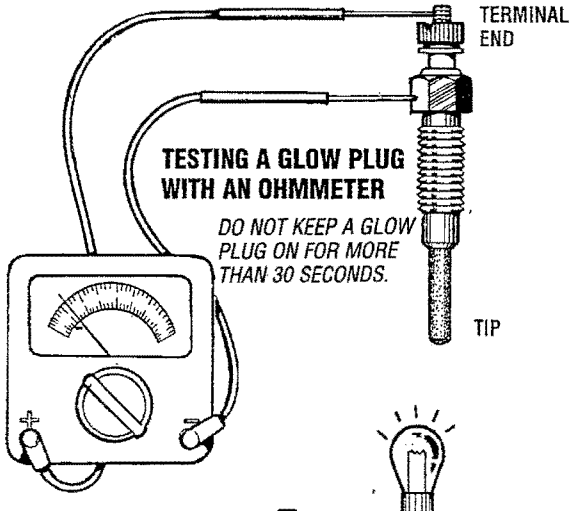
TESTING OIL PRESSURE

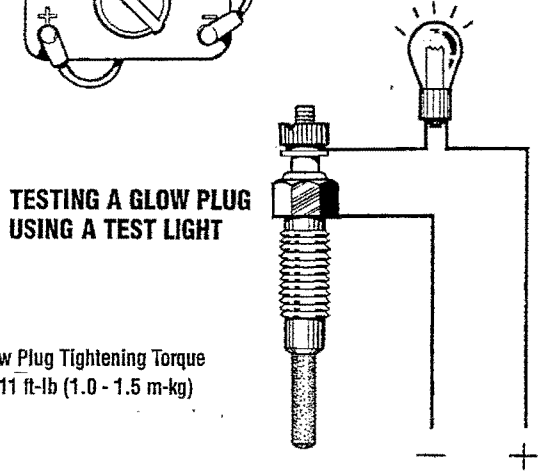
TESTING GLOW PLUGS

To inspect the plug, remove the electrical terminal connections, then unscrew or unclamp each plug from the cylinder head. Thoroughly clean each plug's tip and threads with a soft brush and cleaning solution to remove all the carbon and oil deposits. While cleaning, examine the tip for wear and burn erosion; if it has eroded too much, replace the plug.

An accurate way to test glow plugs is with an ohmmeter. Touch one prod to the glow plug's wire connection, and the other to the body of the glow plug, as shown. A good glow plug will have a 0.4 - 0.6 ohm resistance. This method can be used with the plug in or out of the engine. You can also use an ammeter to test the power drain (5 - 6 amps per plug).

> ⚠ **WARNING:** ***These glow plugs will become very hot to the touch. Be careful not to burn your fingers when testing the plugs.***





Re-install the plugs in the engine and test them again. The plugs should get very hot (at the terminal end) within 7 to 15 seconds. If the plugs don't heat up quickly, check for a short circuit. When reinstalling the glow plugs, use anti-seize compound on the threads.

FUEL INJECTORS

REMOVING THE INJECTORS

NOTE: *Injector must be serviced in a "clean room" environment.*

1. Disconnect the high pressure lines from the injectors and loosen the lines at their attachment to the injection pump and move them out of the way of the injectors. Avoid bending the lines.
2. Using a 17mm long socket, remove the fuel return line in its entirety from the top of the injectors. Take care not to lose the two sealing washers and banjo bolt that attaches the fuel return line to each injector.

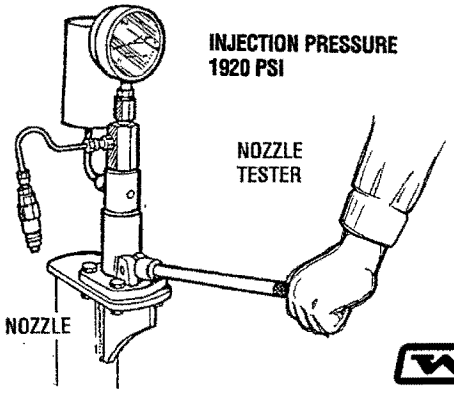
   NOTE: *Clean the area around the base of the injector prior to lifting it out of the cylinder head to help prevent any rust or debris from falling down into the injector hole. If the injector will not lift out easily and is held in by carbon build up or the like, work the injector side to side with the aid of the 17mm deep socket wrench to free it and then lift it out.*
3. The injector seats in the cylinder head on a copper sealing washer. This washer should be removed with the injector and replaced with a new washer when the injector is reinstalled.

INJECTION TESTING

1. Using the nozzle tester, check the spray pattern and injection starting pressure of nozzle and, if it exceeds the limit, adjust or replace the nozzle. When using nozzle tester, take the following precautions:

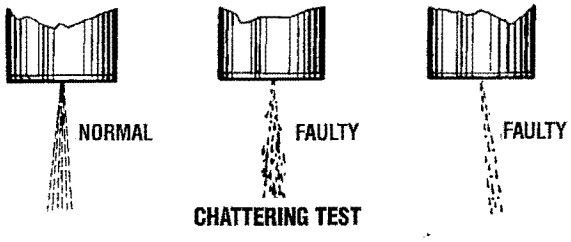
> ⚠ **CAUTION:** ***The spray injected from the nozzle is of such velocity that it may penetrate deeply into the skin of fingers and hands, destroying tissue. If it enters the bloodstream, it may cause blood poisoning.***

   a. If the diesel fuel of the nozzle tester is discolored, replace it. At the same time, clean or replace the filter.
   b. Set the nozzle tester in a clean place where there is no dust or dirt.
   c. Mount the nozzle and nozzle holder on the nozzle tester.
   d. Use the fuel at the approximate temperature of 68° F (20° C)
   e. Operate the hand lever of nozzle tester several times to bleed the air in the nozzle line, then move the hand lever at intervals of one stroke per second while reading the injection starting pressure.



Inspecting Spray Pattern

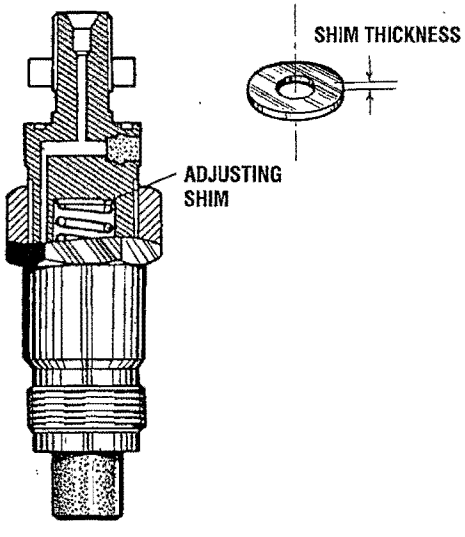
1. Operate the hand lever of the nozzle tester at intervals of one stroke per second to check if the fuel is injected correctly in its axial direction. A nozzle is defective if it injects fuel in an oblique direction or in several separate strips. Also, a spray in the form of particles indicates a defect. These defects may sometimes be caused by clogging with dust and, therefore, all parts should be carefully cleaned before reassembly. (Care should be taken not to expose ones skin to this spray as it may penetrate the skin and cause infection.)



2. Apply the pressure of 1635 lb/in² (115 kg/cm²) to nozzle by operating the hand lever, and check the drips from the nozzle tip. If it drips or has a large accumulation of fuel on the bottom, it is considered defective and should be replaced. A very small amount of fuel may sometimes remain on the tip of the nozzle; however, this does not indicate a defect.

The injection starting pressure for the injectors is adjusted by increasing or decreasing the thickness of the adjusting shim.

The shim has 10 different thicknesses for every 0.0020 in (0.05 mm), between 0.0049in (1.25mm).to 0.0669in (1.7mm) With each 0.0020in (0.05mm) increase, injection pressure is increased approximately 71.1 lb/in² (5.0 kg/cm²). When replacing the shim, grip the retaining nut in a vise and remove the body with a wrench. Tighten the retaining nut to the specified torque.



ENGINE TROUBLESHOOTING

The following troubleshooting table describes certain problems relating to engine service, the probable causes of the problems, and the recommendations to overcome these problems.

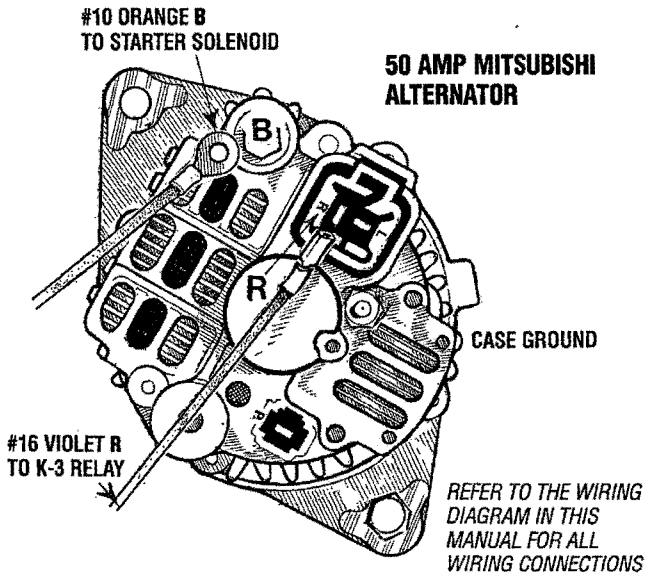
NOTE: The engine's DC electrical system is protected by a 20 amp rocker type manual reset circuit breaker mounted on the generator's control box next to the LCD Display Panel.

Problem	Probable Cause	Verification/Remedy
START BUTTON depressed, no panel indications.	1. Battery Switch not on.	1. Check switch and/or battery connections.
	2. Circuit breaker tripped/off.	2. Reset breaker; if breaker trips again, check preheat solenoid circuit and check circuit for shorts to ground.
	5. Loose battery connections.	4. Check (+) connection to starter solenoid and (-) connection to engine ground stud. Check battery cable connections.
START BUTTON depressed, no starter engagement.	1. Connection to solenoid faulty.	1. Check connection.
	2. Faulty solenoid.	2. Check that 12 volts are present at the solenoid connection.
	3. Loose battery connections.	3. Check battery connections.
	4. Low battery.	4. Check battery charge state.
	5. K1 relay.	5. Check K1 relay.
START BUTTON depressed; panel indications OK; starter solenoid OK fuel solenoid not functioning.	1. Poor connections to fuel solenoid.	1. Check connections.
	2. Defective fuel solenoid.	2. Check that 12 volts are present at the (+) connection on the fuel run solenoid.
Generator engine cranks, but does not start, fuel solenoid energized.	1. Faulty fueling system.	1. Check that fuel valves are open. **1a.** Switch to combine house and start batteries. **1b.** Replace batteries. **1c.** Check fuel lift pump. **1d.** Change inlet fuel filter.
	2. Preheat solenoid faulty.	2. Check solenoid.
Battery runs down.	1. High resistance leak to ground.	1. Check wiring. Insert sensitive (0 - .25 amp) meter in battery lines. **Do not start engine.** Remove connections and replace after short is located.
	2. Low resistance leak.	2. Check all wires for temperature rise to locate the fault.
	3. Poor battery connections.	3. Check cable connections at battery for loose connections, corrosion.
	4. DC alternator not charging.	4. Check connections, check belt tension. test alternator. See *DC ELECTRICAL SYSTEM/ALTERNATOR.*
Battery not charging	1. DC charge circuit faulty.	1. Perform D.C. voltage check of generator charging circuit. See *DC ELECTRICAL SYSTEM/ALTERNATOR* in this manual.
	2. Alternator drive.	2. Check drive belt tension. Alternator should turn freely. Check for loose connections. Check output voltmeter. Ensure 12 volts are present at the Exc. terminal.
Generator engine stops.	1. Fuel feed pump strainer is dirty.	1. Clean strainer (32 KW only).
	2. Switches and/or wiring loose or disconnected.	2. Inspect wiring for short circuits and loose connections. Inspect switches for proper operation.
	3. Fuel starvation.	3. Check fuel supply, fuel valves, fuel feed strainer.
	4. 20 Amp circuit breaker tripping.	4. Check for high DC amperage draw during operation. Ensure breaker is not overly sensitive to heat which would cause tripping.
	5. Exhaust system is restricted.	5. Check for blockage or collapsed muffler.
	6. Water in fuel.	6. Pump water from fuel tank(s); change filters and bleed fuel system.
	7. Air intake obstruction.	7. Check air intake filter cartridge.
Engine starts, runs and shuts down.	1. Faulty oil pressure switch.	1. Check oil pressure switch.
	2. Water temperature switch.	2. Check water temperature switch.

ENGINE TROUBLESHOOTING

Problem	Probable Cause	Verification/Remedy
Exhaust smoking problems	**1.** Blue smoke.	**1.** Incorrect grade of engine oil.
		1a. Crankcase is overfilled with engine oil (oil is blowing out through the exhaust).
	2. White smoke.	**2.** Engine is running cold.
		2a. Faulty injector or incorrect injector timing.
	3. Black smoke.	**3.** Improper grade of fuel.
		3a. Fuel burn incomplete due to high back pressure in exhaust or insufficient air for proper combustion (Check for restrictions in exhaust system; check air intake.).
		3b. Improperly timed injectors or valves or poor compression.
		3c. Lack of air — check air intake and air filter. Check for proper ventilation.
		3d. Overload.
LCD DISPLAYS		
No LCD Display	**1.** Check battery.	**1.** Battery on.
	2. 20 amp breaker off.	**2.** Turn breaker on.
Oil Pressure	**1.** Oil level low/oil leak.	**1.** Check oil level, add oil and repair leaks.
	2. Lack of oil pressure	**2.** Test oil pressure. If OK, test oil pressure sendor, inspect oil filter, inspect oil pump.
	3. Ground connection.	**3.** Check ground connection.
	4. Faulty control module.	**4.** Inspect all the plug connections/replace.
Coolant Temperature	**1.** Check system coolant level.	**1.** Add coolant. Check for leaks.
	2. Check water pump drive belt.	**2.** Adjust belt tension, replace belt.
	3. Faulty Temp sensor.	**3.** Check sensor/replace.
	4. Ground Connection.	**4.** Check ground circuit.
	5. Faulty control module.	**5.** Check plug connections/replace.
Exhaust Temperature	**1.** Check sea water flow.	**1.** Inspect thru hull fitting, hose and strainer. Correct as needed.
	2. Faulty exhaust temp switch.	**2.** Test/replace.
	3. Ground Connection.	**3.** Check ground circuit.
	4. Faulty control module.	**4.** Check plug connections.
	5. Sea water pump.	**5.** Inspect impeller/replace.
Battery Voltage	**1.** Check alternator drive belt.	**1.** Adjust tension/replace if worn.
	2. Check charge voltage.	**2.** Check excitation. replace/repair alternator
	3. Check battery connections.	**3.** Check + and - cables from battery to engine.
	4. Faulty control module.	**4.** Check plug connections/replace.
Generator Voltage	**1.** Check AC voltage output.	**1.** Adjust voltage/troubleshoot generator for cause.
	2. Faulty control module.	**2.** Check plug connections/replace.
Generator Frequency	**1.** Check engine speed.	**1.** Adjust.
	2. Check fuel supply.	**2.** Inspect filters/replace filters. Test fuel pump operation.
	3. Amperage load.	**3.** Check load with amprobe.
LED Display - edges turn pink.	**1.** Compartment ambient temperature too high.	**1.** Ventilate compartment. **NOTE:** Heat will often change the color of an LCD display. This will not effect the operation of the engine.

ALTERNATORS TESTING/TROUBLESHOOTING



DESCRIPTION

The following information applies to the standard alternators that are supplied with WESTERBEKE'S Engines and Generators.

ELECTRICAL CHARGING CIRCUIT

The charging system consists of an alternator with a voltage regulator, an engine DC wiring harness, a mounted DC circuit breaker and a battery with connecting cables. Because of the use of integrated circuits (IC's), the electronic voltage regulator is very compact and is mounted internally or on the back of the alternator.

It is desirable to test the charging system (alternator and voltage regulator) using the wiring harness and electrical loads that are a permanent part of the system and will then provide the technician with an operational test of the charging system as well as the major components of the electrical system.

ALTERNATOR DESCRIPTION

The stator is connected to a three-phase, full-wave bridge rectifier package which contains six diodes. The bridge converts the AC generated in the stator to a DC output for battery charging and accessories,

Power to the regulator and the field of the integral regulator alternator is provided by the field diode (or diode trio) package contained in the alternator.

These alternators produce a rated output of 50 or 51 amps. rated output is achieved at approximately 6000 alternator rpm at an ambient temperature of 75°F (23.8°C). The alternators are designed to operate in an ambient temperature range of -40° to 212°F (-40° to 100°C).

VOLTAGE REGULATOR

The integral voltage regulator is an electronic switching device which senses the system voltage level and switches the voltage applied to the field in order to maintain a proper system voltage.

The regulator design utilizes all-silicon semi conductors and thick-film assembly techniques. After the voltage has been adjusted to the proper regulating valve, the entire circuit is encapsulated to protect the circuit and the components from possible damage due to handling or vibration.

ALTERNATOR TROUBLESHOOTING

Use this troubleshooting section to determine if a problem exists with the charging circuit or with the alternator. If it is determined that the alternator or voltage regulator is faulty, have a qualified technician check it.

> ⚠ **WARNING:** ***A working alternator runs hot. A failed alternator can become very hot. Do not touch the alternator until if has cooled.***

LOW BATTERY/FAULTY CIRCUIT

If the starter only moans or makes a clicking sound instead of spinning the engine to life it is likely a low battery or a faulty connection in the starting circuit and not an alternator problem.

PRELIMINARY INSPECTION

Before starting the actual alternator and voltage regulator, testing the following checks are recommended.

1. Make certain your alternator is securely mounted.
2. Check the drive belts for proper tension. Replace the belt if it is worn or glazed.
3. Check that all terminals, connectors and plugs are clean and tight. Loose or corroded connections cause high resistance and this could cause overcharging, undercharging or damage to the charging system. Badly corroded battery cables could prevent the battery from reaching a fully charged condition.
4. Check the condition of the battery and charge if necessary. A low or discharged battery may cause false or misleading readings in the tests.

NOTE: *An isolator with a diode, a solenoid, or a battery selector switch is usually mounted in the circuit to isolate the batteries so the starting battery is not discharged along with the house batteries. If the isolator is charging the starting battery but not the house battery, the alternator is OK and the problem is in the battery charging circuit.*

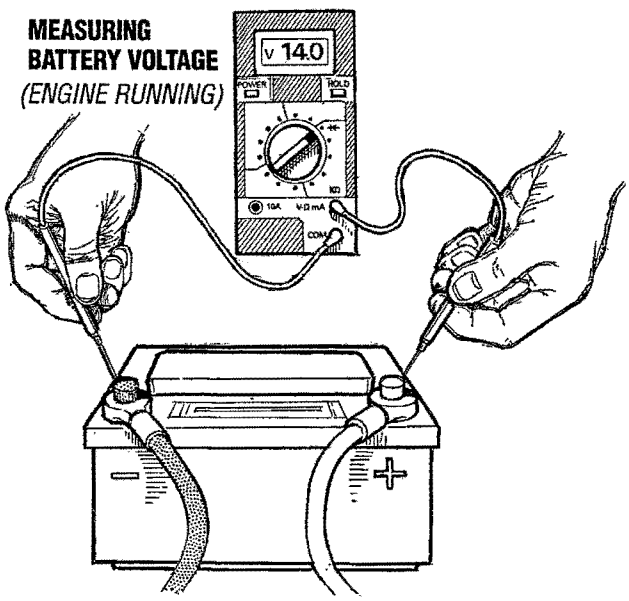
ALTERNATORS TESTING/TROUBLESHOOTING

TESTING THE ALTERNATOR

> ⚠ **CAUTION:** ***Before starting the engine make certain that everyone is clear of moving parts! Keep away from sheaves and belts during test procedures.***

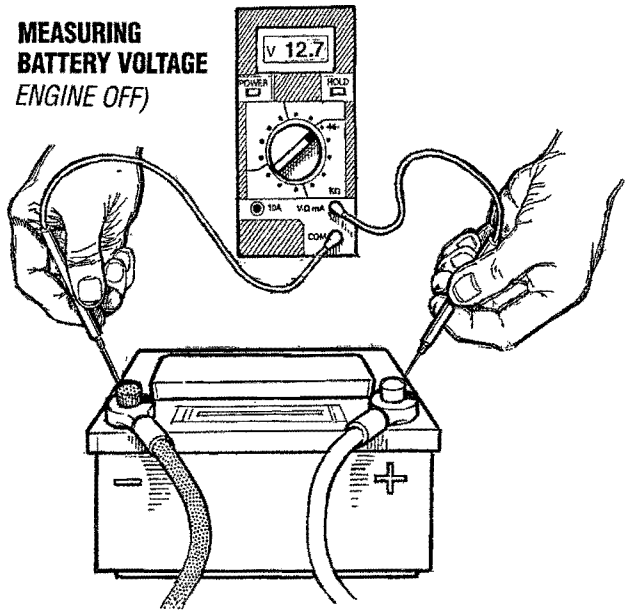
1. **Start the Engine.**
2. After the engine has run for a few minutes, measure the starting battery voltage at the battery terminals using a multimeter set on DC volts.
   - **a.** If the voltage is increasing toward 14 volts, the alternator is working.
   - **b.** If the voltage remains around 12 volts, a problem exists with either the alternator or the charging circuit; continue with Steps 3 through 6.

MEASURING BATTERY VOLTAGE *(ENGINE RUNNING)*



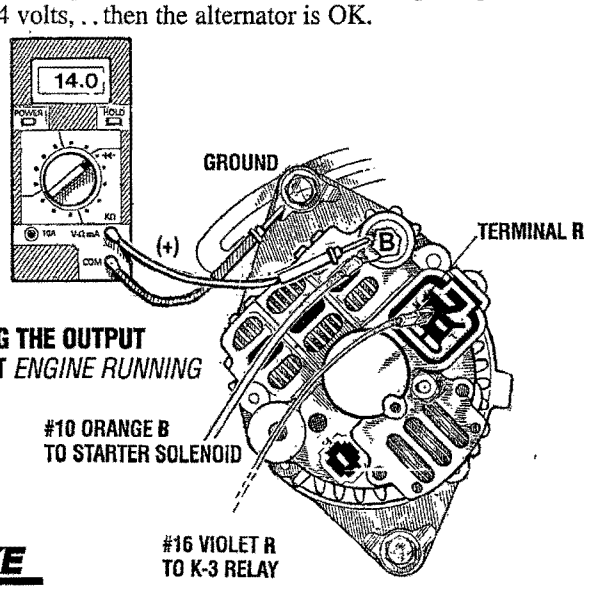
3. **Turn off the engine.** Inspect all wiring and connections. Ensure that the battery terminals and the engine ground connections are tight and clean
4. If a battery selector switch is in the charging circuit,ensure that it is on the correct setting.
5. Check the battery voltage. If your battery is in good condition the reading should be 12 to 13 volts.

MEASURING BATTERY VOLTAGE *ENGINE OFF)*



TESTING THE OUTPUT CIRCUIT

1. Connect the positive probe to the output terminal **B** and connect the negative probe to ground.
2. Wiggle the engine wiring harness while observing the voltmeter. The meter should indicate the approximate battery voltage, and should not vary. If no reading is obtained, or if the reading varies, check the alternator output circuit for loose or dirty connections or damaged wiring.
3. **Start the engine.**
4. Repeat the same measurement, the negative probe to ground, the positive probe to **B** with the engine running. The voltage reading should be between 13.5 and 14.5 volts. If your alternator is over or under-charging, have it repaired at a reliable service shop.
5. If the previous test reads only battery voltage at terminal **B**, use the meter to measure the DC excitation terminal. If 12 volts is not present at exciter terminal **R**, inspect the wiring for breaks and poor connections. Jump 12 volts from a 12 volt source (such as the battery) and operate the alternator. If the voltage output is 13-14 volts, . . then the alternator is OK.

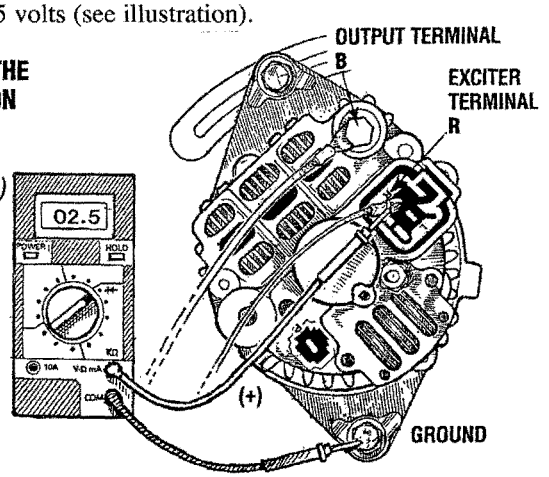


TESTING THE OUTPUT CIRCUIT *ENGINE RUNNING*

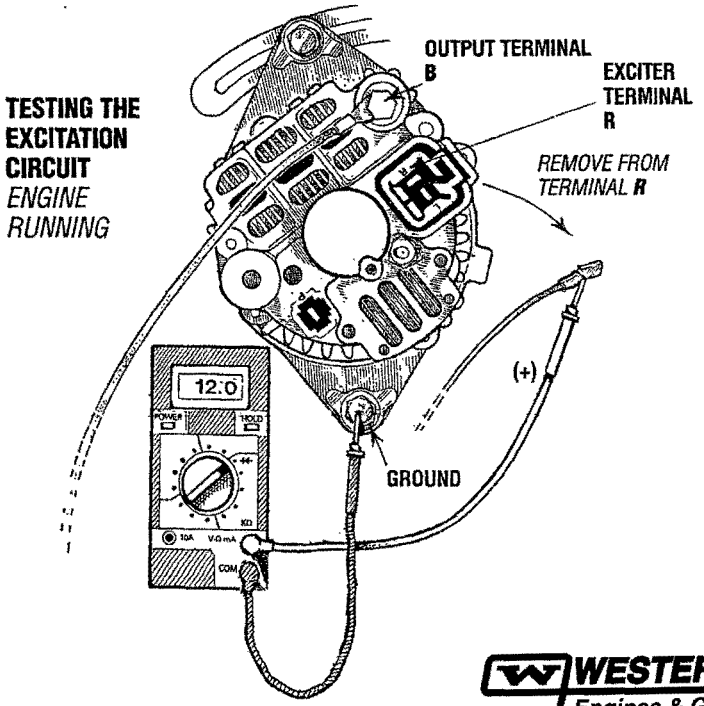
ALTERNATORS TESTING/TROUBLESHOOTING

TESTING THE EXCITATION CIRCUIT

1. Connect the positive (+) multimeter probe to the excitation terminal **R** on the alternator and the negative (–) lead to ground.
2. **Turn the battery switch to the on position** and note the multimeter reading. The reading should be 1.3 to 2.5 volts (see illustration).



3. **If the reading is between .75 and 1.1 volts,** the rotor field circuit probably is shorted or grounded.
4. **If the reading is between 6.0 and 7.0 volts,** the rotor field circuit probably is open.
5. **If no reading is obtained,** an open exists in the alternator-excitation lead or in the excitation circuit of the regulator. Disconnect the lead from exc terminal **R**. Connect the positive multimeter probe to the excitation lead and the negative multimeter probe to ground. If the multimeter now indicates an approximate battery voltage, the voltage regulator is defective and must be replaced. If no voltage is indicated, check the excitation circuit for loose or dirty connections or damaged wiring.



CHECKING THE SERVICE BATTERY

Check the voltage of the service battery. this battery should have a voltage between 13 and 14 volts when the engine is running. If not, there is a problem in the service battery charging circuit. Troubleshoot the service battery charging circuit by checking the wiring and connections, the solenoid, isolator, battery switch, and the battery itself.

When the problem has been solved and before the alternator is back in operation, take the time to tighten and clean the terminal studs. Also clean the connecting terminals from the wiring harness.

ALTERNATOR REPAIR

If tests indicate a failed alternator, it will need to be disassembled and repaired. Any good alternator service shop can do the job.

NOTE: *WESTERBEKE'S Service Manual has detailed instructions for the disassembly and repair of their standard alternators.*

BATTERY CARE

The minimum recommended capacity of the battery used in the engine's 12 volt DC control circuit is 600 – 900 Cold Cranking Amps (CCA).

Review the manufacturer's recommendations and then establish a systematic maintenance schedule for your engine's starting batteries and house batteries.

- Monitor your voltmeter for proper charging during engine operation.
- Check the electrolyte level and specific gravity with a hydrometer.
- Use only distilled water to bring electrolytes to a proper level.
- Make certain that battery cable connections are clean and tight to the battery posts (and to your engine).

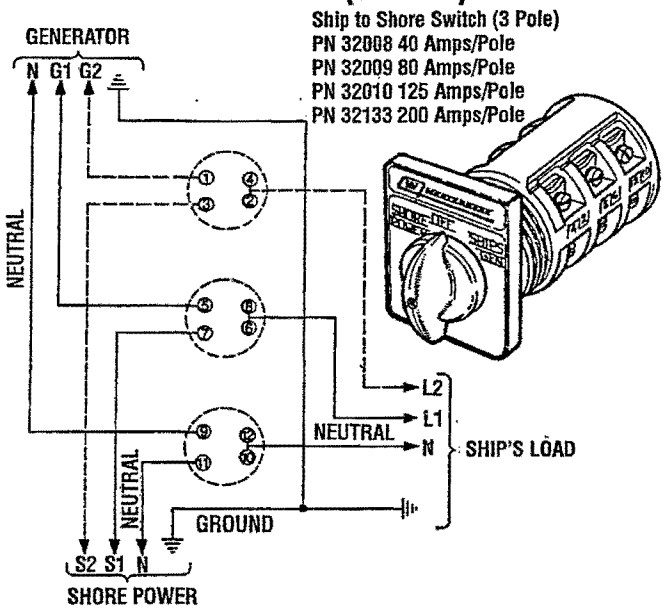
7.6 KW BT SHORE POWER TRANSFER SWITCH CONNECTIONS

If the installer connects shore power to the vessel's AC circuit, this must be done by means of the SHORE POWER/ OFF/SHIPS GEN. Set the transfer switch shown in the diagrams to the OFF position. This switch prevents simultaneous connection of shore power to generator output.

> ⚠ **CAUTION:** ***Damage to the generator can result if utility shore power and generator output are connected at the same time. This type of generator damage is not covered under the warranty; it is the installer's responsibility to make sure all AC connections are correct.***

> ⚠ **CAUTION:** ***Heavy motor leads should be shut off before switching shore power to generator power or vice-versa because voltage surges induced by switching with heavy AC loads on the vessel being operated may cause damage to the exciter circuit components in the generator.***

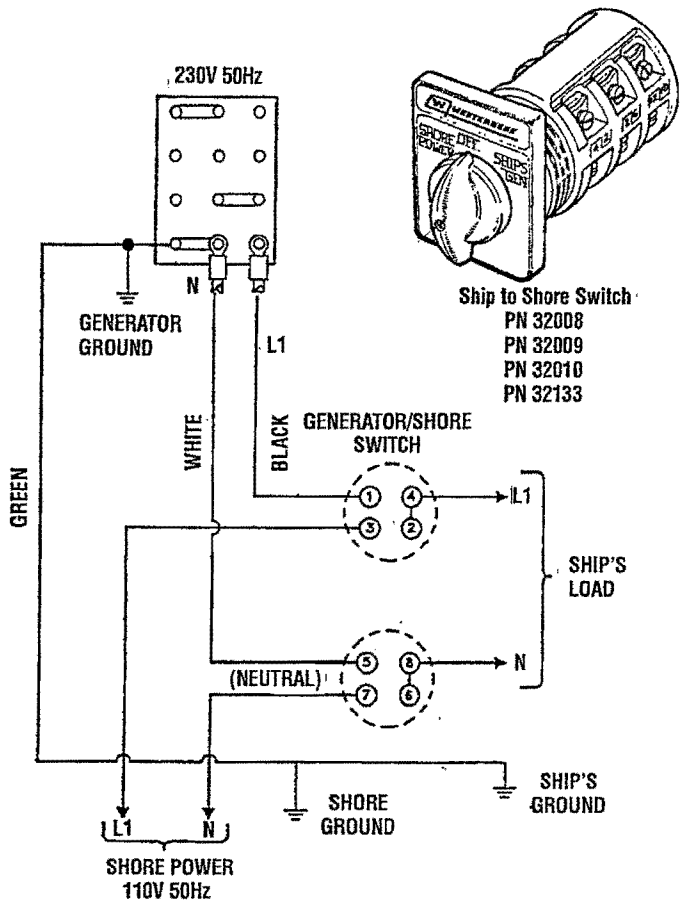
Shore Power Connections (60 Hertz)



NOTE: *Diagram shows connections for a two-wire, 120 volt system. For a three-wire system, use the dotted lines for the other hot leg.*

230 Volt/50 Hertz Two Wire Configuration

Notice the repositioning of the white ground lead on the terminal block to the generator case.



GENERATOR INFORMATION

USE OF ELECTRIC MOTORS

The power required to start an electric motor is considerably more than is required to keep it running after it is started. Some motors require much more current to start them than others. Split-phase (AC) motors require more current to start, under similar circumstances, than other types. They are commonly used on easy-starting loads, such as washing machines, or where loads are applied after the motor is started, such as small power tools. Because they require 5 to 7 times as much current to start as to run, their use should be avoided, whenever possible, if the electric motor is to be driven by a small generator. Capacitor and repulsion-induction motors require from 2 to 4 times as much current to start as to run. The current required to start any motor varies with the load connected to it. An electric motor connected to an air compressor, for example, will require more current than a motor to which no load is connected.

In general, the current required to start 115-Volt motors connected to medium starting loads will be approximately as follows:

MOTOR SIZE (HP)	AMPS FOR RUNNING (AMPERES)	AMPS FOR STARTING (AMPERES)
1/6	3.2	6.4 to 22.4*
1/4	4.6	9.2 to 32.2*
1/3	5.2	10.4 to 72.8*
1/2	7.2	14.4 to 29.2*
3/4	10.2	20.4 to 40.8*
1	13	26 to 52

***NOTE:** *In the above table the maximum* Amps for Starting *is more for some small motors than for larger ones. The reason for this is that the hardest starting types (split-phase) are not made in larger sizes.*

Because the heavy surge of current needed for starting motors is required for only an instant, the generator will not be damaged if it can bring the motor up to speed in a few seconds. If difficulty is experienced in starting motors, turn off all other electrical loads and, if possible, reduce the load on the electric motor.

Required Operating Speed

Run the generator first with no load applied, then at half the generator's capacity, and finally loaded to its full capacity as indicted on the generator's data plate. The output voltage should be checked periodically to ensure proper operation of the generating plant and the appliances it supplies. If an AC voltmeter or ampere meter is not installed to monitor voltage and load, check it with a portable meter and amp probe.

NOTE: *When the vessel in which the generator is installed contains AC equipment of 120 volts only, it is recommended that the generator's AC terminal block be configured to provide one 120 volt AC hot leg for the vessel's distribution panel. This will ensure good motor starting response from the generator.*

Generator Frequency Adjustment

Frequency is a direct result of engine/generator speed, as indicated by the following:

- When the generator is run at 1800 RPM, the AC voltage output frequency is 60 Hertz.
- When the generator is run at 1500 RPM, the AC voltage output frequency is 50 Hertz.

Therefore, to change the generator's frequency, the generator's drive engine's speed must be changed. A reconfiguration of the AC output connections at the generator is also necessary.

Generator Maintenance

- Maintaining reasonable cleanliness is important. Connections of terminal boards and rectifiers may become corroded, and insulation surfaces may start conducting if salts, dust, engine exhaust, carbon, etc. are allowed to build up. Clogged ventilation openings may cause excessive heating and reduced life of windings.
- For unusually severe conditions, thin rust-inhibiting petroleum-base coatings, should be sprayed or brushed over all surfaces to reduce rusting and corrosion. Typical materials suggested are Daubert Chemical Co. "Non-Rust AC-410" and Ashland "Tectyle 506" or equivalent.
- In addition to periodic cleaning, the generator should be inspected for (a) tightness of all connections, (b) evidence of overheated terminals and (c) loose or damaged wires.
- The drive discs on single bearing generators should be checked periodically if possible for tightness of screws and for any evidence of incipient cracking failure. Discs should not be allowed to become rusty because rust may accelerate cracking. The bolts which fasten the drive disc to the generator shaft must be hardened steel SAE grade 8, identified by 6 radial marks, one at each of the 6 corners of the head.
- The rear armature bearing is lubricated and sealed; no maintenance is required. However, if the bearing becomes noisy or rough-sounding, have it replaced.
- Examine bearing at periodic intervals. No side movement of shaft should be detected when force is applied. if side motion is detectable, bearings are wearing or wear on shaft of bearing socket outside bearing has occurred. Repair must be made quickly or major components will rub and cause major damage to generator.

7.6KW BT GENERATOR SINGLE PHASE

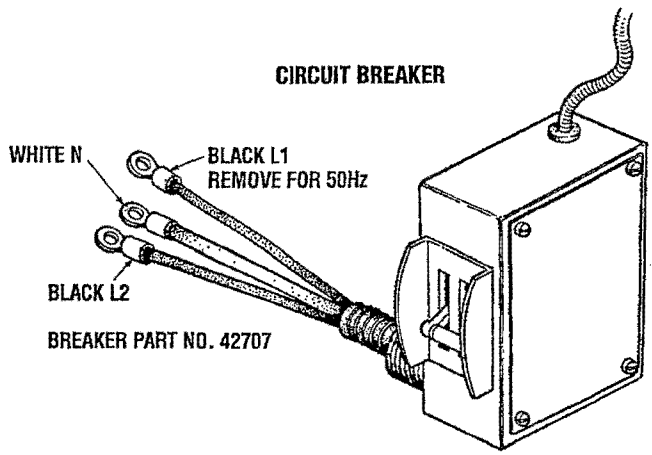
DESCRIPTION

This generator is a four-pole, brushless, self-excited generator which requires only the driving force of the engine to produce AC output. The copper and laminated iron in the exciter stator are responsible for the self-exciting feature of this generator. The magnetic field produced causes an AC voltage to be induced into the related exciter rotor windings during rotation.Diodes located in the exciter rotor rectify this voltage to DC and supply it to the windings of the rotating field. This creates an electromagnetic field which rotates through the windings of the main stator, inducing an AC voltage which is supplied to a load. A step down transformer is connected in parallel to the AC output of the main stator. An AC voltage is produced in the auxiliary windings of the transformer and the main stator and is, in turn, supplied to a full-wave bridge rectifier. The rectifier produces a DC voltage to further excite the exciter stator windings, enabling the generator to produce a rated AC output.

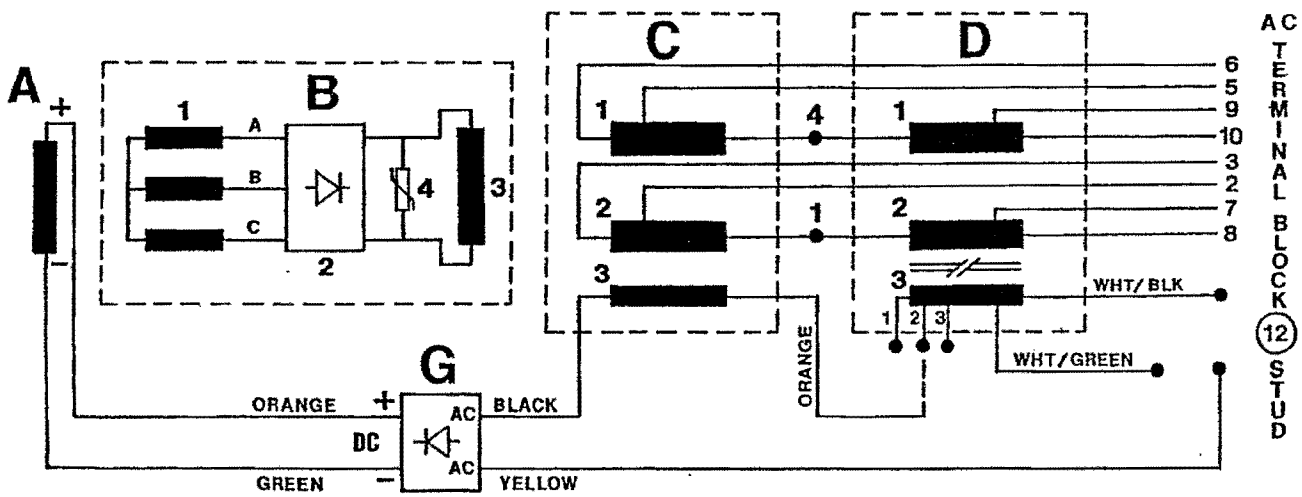
Circuit Breaker

A circuit breaker is installed on all WESTERBEKE generators. This circuit breaker will automatically disconnect generator power in case of an electrical overload. The circuit breaker can be manually shut off when servicing the generator to ensure no AC power is coming from the generator to the vessel.

NOTE: *This circuit breaker is available as a WESTERBEKE add-on kit for earlier model generations; contact your WESTERBEKE dealer.*



INTERNAL WIRING FOR 12 STUD BT GENERATOR



A. EXCITER STATOR WINDING
A - 1 Exciter Stator Windings

B. EXCITER ROTOR and FIELD
1. Auxiliary Windings (A - B - C)
2. Diodes (6)
3. Rotating Field Windings
4. Pozi Resistor

C. MAIN STATOR
1. Main Stator Windings
2. Main Stator Windings
3. Main Stator Auxiliary Windings

D. COMPOUND TRANSFORMER
1. Compound Transformer Windings
2. Compound Transformer Windings
3. Compound Transformer Auxiliary Windings

Resistance readings and voltage checks can be accessed easily for the components in the exciter circuit A, G, C-3 and D-3 by locating the color coded wires at the connection points shown on the above schematic. When checking winding resistance values be sure to lift both of the component's electrical connections.

G. BRIDGE RECTIFIER

7.6KW BT GENERATOR TROUBLESHOOTING

The following troubleshooting chart is designed to give insight into problems which may be encountered with the BT brushless generators operating on compound transformer regulation. Owing to the simplicity of the equipment and controls, troubleshooting is relatively easy, once the relationship between cause and effect is understood. Most potential problems are covered in the text of this guide; however should an omission or an error be found, we would greatly appreciate your notifying us of it.

Keep in mind that a basic fundamental knowledge of electricity is required for this troubleshooting, and always remember that lethal voltages are present in the circuitry; therefore, extreme caution is essential when troubleshooting a generator.

Only a few basic tools are necessary for diagnosis and repair. These are hand tools: an amp probe and a quality volt-ohm-meter capable of reading less than one ohm due to the precision required in reading component winding resistances.

Before attempting any repairs, get a clear an explanation of the problem as possible, preferably from an individual witnessing the problem. In some cases, this may bring to light a problem which is related to the method of operation rather than equipment fault. Bring basic repair tools with you on the initial trip to the problem equipment, such as: diodes and bridge rectifier, so that if the problem should be found in one of these easily replaceable parts, the problem can be remedied early and efficiently.

TROUBLESHOOTING CHART

*REFER TO THE **INTERNAL WIRING DIAGRAM** WHEN PERFORMING THE FOLLOWING TESTS.*

TROUBLESHOOT THE COMPONENTS IN THE FOLLOWING ORDER:

1. **LOW VOLTAGE** 60-100 VOLTS AC

COMPONENT CHECKS:

B ROTOR COMPONENTS
- **B2.** EXCITER ROTOR DIODES
- **B3.** ROTOR FIELD WINDING
- **B1.** EXCITER ROTOR WINDING(S) **a,b,c.**

A EXCITER STATOR WINDING

2. **NO AC VOLTAGE OUTPUT**

MAIN STATOR, ROTOR COMPONENTS, TRANSFORMER

COMPONENT CHECKS:

C 1+2 MAIN STATOR WINDING
B 4 POSI RESISTOR
B 2 DIODES (4-6 OPEN/SHORTED)
D 1+2 COMPOUND TRANSFORMER WINDING
B 3 ROTOR FIELD WINDING

3. **RESIDUAL VOLTAGE** EXCITER CIRCUIT FAULTY

COMPONENT CHECKS:

A 1-1+2 EXCITER STATOR WINDING(S)
G BRIDGE RECTIFIER
D 3 TRANSFORMER AUX. WINDING
C 3 MAIN STATOR AUX. WINDING

7.6KW BT GENERATOR SINGLE PHASE

NO-LOAD VOLTAGE ADJUSTMENT

1. Voltage adjustment is made with the generator regulation being governed by the compound transformer.

2. Operate the generator, apply a moderate load momentarily and remove it. Note the voltage output from the generator's 120 volt leg(s), (230 volt 50 hertz). The no-load voltage should be between 121-124 volts at 60.0-60.5 hertz (234-238 volts at 50.0-50.5 hertz).

   NOTE: *The no-load voltage should be adjusted to the voltage produced by the generator once started and a momentary load should be applied to excite the transformer and then removed. The voltage produced by the generator after this momentary load is removed is no-load voltage.*

3. To raise or lower the voltage, shims of varying thickness (non-conductive material) are placed or removed from under the steel laminated bar on top of the compound transformer. The material used for shimming should not soften at temperatures in the 176° F (80° C) range. A small reduction in no-load voltage (1 to 3 volts) can sometimes be accomplished by gently tapping the top of the laminated steel bar to reduce the gap between the existing shims and the transformer core.

CHANGING FREQUENCY 50/60Hz

When changing frequency, refer to the digital control panel pages 7&8 and position switch #1 on the ECU in the correct position for the hertz selected.

1. Frequency is a direct result of engine/generator speed: 1800 rpm = 60 hertz; 1500 rpm = 50 hertz.
2. To change generator frequency follow the steps below.
   a. Configure the AC terminal block for the desired voltage frequency as shown below. Ensure that the case ground wire is connected to the correct terminal block neutral ground stud.

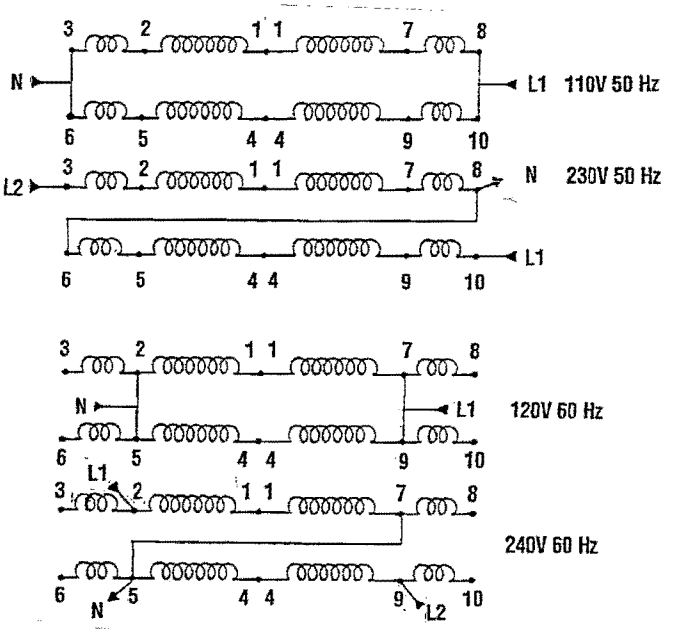
      NOTE: *The white/green ground wire may be removed in those installations where the AC circuit has a separate neutral and ground circuit. This will prevent the unit from being a ground source in the vessel.*

   b. Start the engine, monitor AC voltage. Adjust no-load AC voltage output as needed.

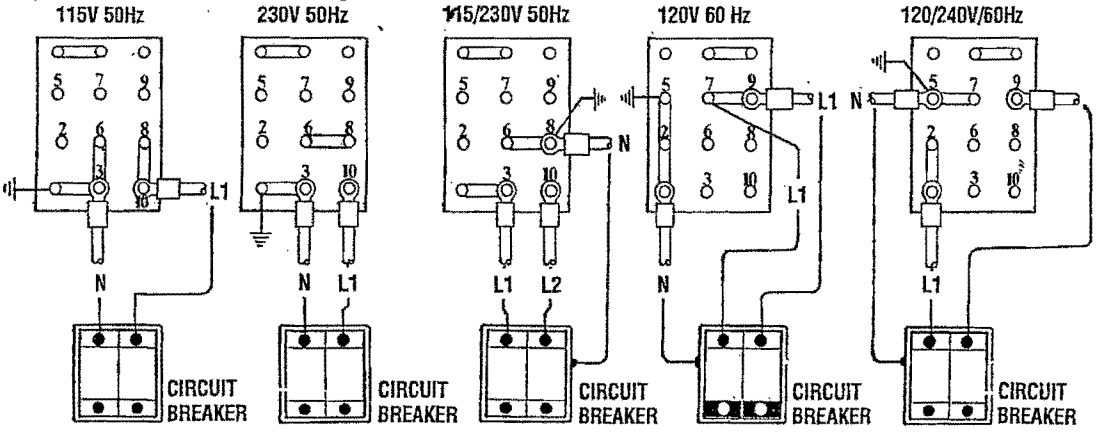
   c. After the no-load hertz adjustment is made, the no-load voltage may need to be readjusted. In most cases, if the generator was producing the correct no-load voltage at the previous hertz setting, it would be correct at the changed hertz setting.
   In the event it needs adjustment, adjust the shim thickness under the laminated steel bar of the transformer.
   60 hertz: no-load voltage, 121 - 124 volts.
   50 hertz: no-load voltage, 234 - 238 volts.

   d. Load the generator to the rated amperage output corresponding to the hertz speed of the generator.
   Rated Loaded Speed
   60 hertz: loaded speed, 59.5 – 60.0 Hertz
   50 hertz: loaded speed, 49.5 – 50.0 Hertz
   Maximum voltage drop acceptable at full rated output (amps)
   60 hertz: 108 - 110 volts
   50 hertz: 215- 220 volts
   Should the voltage drop below the proper rate, loaded excitation can be increased to raise this voltage by repositioning the connection on the Voltage Connection Terminal.

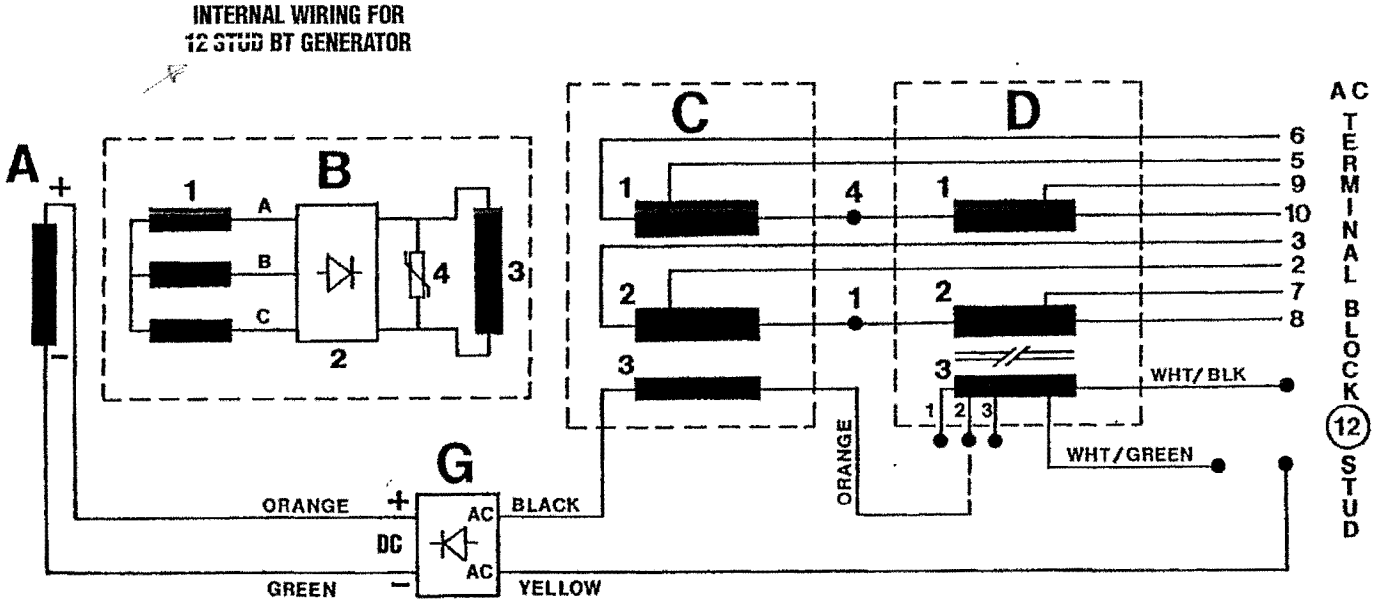
TERMINAL BLOCK WIRING CONNECTIONS
Winding Connections Needed To Obtain The Proper Voltage and Frequency



The frame ground wire must be moved when changing from 115 volts and 110/220 volts 50 hertz to 230 volts 50 hertz. From making connections to the AC terminal block, use terminal ends for 1/4 inch studs that will accept multi-strand copper wire sized for the amperage rating from the hot lead connection. The frame ground wire is white or white with a green strip. It connects between the neutral stud and the generator frame.



7.6KW BT GENERATOR SINGLE PHASE



RESIDUAL VOLTAGE CHECK

1. . Residual Voltage 18 - 22 volts AC.

   NOTE: *The amount of no-load voltage produced by the generator can be an indicator of where in the generator the problem/fault may lie.*

   This voltage is the AC voltage produced by the generator from magnetism in the exciter stator field. This voltage is measured between the AC neutral and hot leg(s) with no-load on the generator running at its hertz.

   The presence of residual voltage is an indication that the following generator components are OK:

   1. Exciter Rotor (B-1 a, b, & c) & (B-2)
   2. Rotating Field (B-3)
   3. Main Stator (C-1 & C-2)
   4. Compound Transformer (D-1 & D-2)

   The fault lies in one or more of the following components in the exciter circuit:

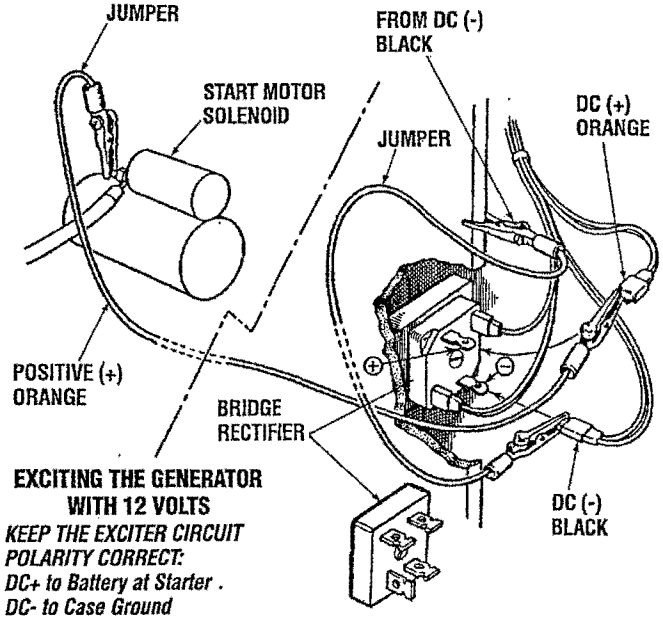
   A. Exciter Stator (A)
   B. Bridge Rectifier (G)
   C. Main Stator Auxiliary Windings (C-3)
   D. Compound Transformer Auxiliary Winding (D-3)

2. Twelve (12) volts DC excitation of the exciter stator windings should cause the generator to produce between 125 - 135 volts AC between each hot lead and the neutral. (Twelve volts DC is applied between the lifted (+) and (–) leads of the bridge rectifier, + to + and – to –.) Correct voltage produced with twelve volts DC excitation indicates the fault is in one or more of the above listed components B, D or E. If the generator does not produce 125 - 135 volts AC, then include A and C.

3. The absence of any voltage from the generator indicates a fault with the main stator windings C-1 and C-2 and/or the compound transformer windings D-1 and D-2. Other failed components that can produce this same no-voltage output are the posi-resistor in the exciter rotor and four or more failed diodes in the exciter rotor.

   a. Apply 12 volt DC excitation to the exciter stator windings as explained in paragraph 2. A fault in the main stator and/or compound transformer windings such as a short will cause the generator engine to load down and the shorted windings to eventually produce smoke as the excitation is continued.

4. Voltage output greater than residual and less than the rated output indicates a fault in the exciter rotor/field B-1, B-2, B-3. Excitation of the generator as explained in paragraph 2 should produce a partial rise in voltage output and, when removed, the voltage will return to the original low output.



NOTE: *Current model bridge rectifiers are configured differently, but + and - are still located at the corners.*

BRIDGE RECTIFIER

The bridge rectifier is supplied AC voltage from the auxiliary windings in the generator stator (C-3) and the compound transformer (D-3). The AC voltage measured across the AC terminals of the rectifier during engine operation is as follows:

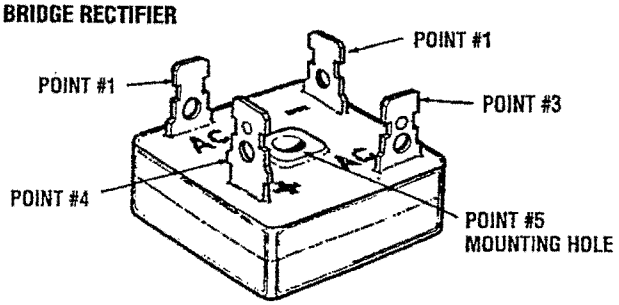
120 Volts	120/240 Volts
N/L F/L	N/L F/L
15 – 50 Volts AC	15 – 50 Volts AC

Diodes in the rectifier convert this AC voltage to DC and supply it to the windings of the exciter stator to induce a field through which the exciter rotor revolves. The DC voltage measured across the (+) and (–) terminals of the bridge rectifier during engine operation is as follows:

120 Volts	120/240 Volts
N/L F/L	N/L F/L
8 - 17 Volts DC	8 - 17 Volts DC

Failure of the bridge rectifier will result in a weak field being produced by the exciter stator windings. A weak field is present, due to the magnetism in the exciter stator, which will cause the generator to produce residual voltage.

BRIDGE RECTIFIER



Testing The Bridge Rectifier For Faults With An Ohmmeter

(Meter used: *Simpson 260*)

1. Set the ohmmeter scale on RX1 (+ DC) and set the needle to zero.
2. Connect the positive (+) lead from the ohmmeter to point #4. Taking the ohmmeter's negative (–) lead, momentarily contact points #1, #2, #3, and #5. The ohmmeter should register no deflection for any of the points touched.
3. Remove the positive (+) lead from point #4 and connect the negative (–) lead to point #4 and, with the positive (+) lead, momentarily touch points #1, #2, and #3. The ohmmeter's needle should deflect when each point is touched, showing a passage of meter voltage through the diodes in the rectifier.
4. Leaving the negative (-) ohmmeter lead on point #4, touch point #5 with the positive (+) lead. No deflection of the needle should occur.
5. Place the positive (+) lead of the ohmmeter on point #1 and the negative (–) lead on point #3. The ohmmeter should not register any deflection of the needle (no deflection indicates infinite resistance). Reverse these connections and the ohmmeter should again register no deflection.
   If the rectifier fails any of the previous tests (1 -4) it is defective and should be replaced.

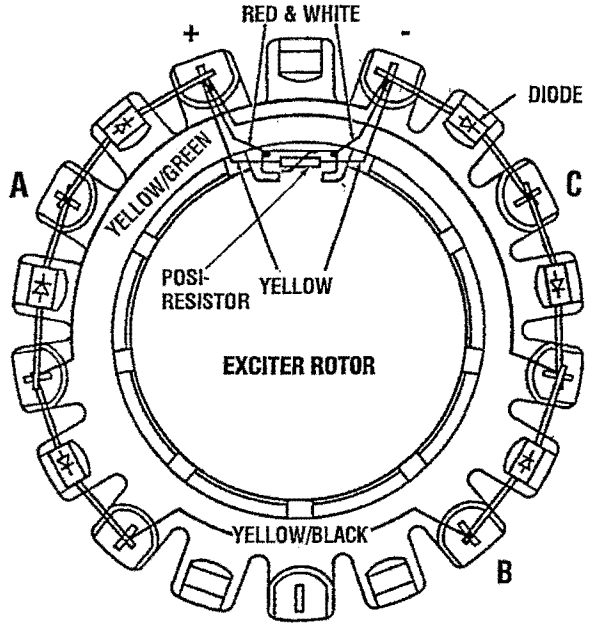
NOTE: *Different style/model meters may produce opposite results from the above tests.*

7.6KW BT GENERATOR SINGLE PHASE

EXCITER ROTOR/FIELD

Auxiliary windings group a, b and c. Locate the three terminal points on the exciter rotor for these auxiliary winding groups. Position the exciter rotor as shown in the illustration and count off the porcelain knobs from the 12 o'clock point either left or right to locate terminal points a, b and c. Measure the resistance value between the pairs of terminal points A & B, B & C, and C & A. There is no need to unsolder these connections unless a faulty reading appears. If this occurs, unsolder and verify the winding fault. There should be no continuity found between any of the three terminal points and the rotor shaft/case ground.

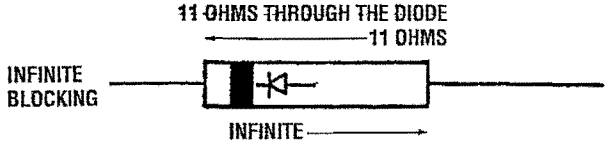
Auxiliary Windings 1.0 - 1.2 Ohms



Rotating Field Windings. Refer to the illustration above of the exciter rotor. The field winding connections are noted as the (+) and (–) connections of the red & white striped wires. Measure the resistance value with your ohmmeter between these two connection points. These connections need not be unsoldered unless a faulty reading appears. If this occurs unsolder the connection and verify the resistance reading. With these connections lifted, there should be no continuity to the rotor shaft. This would indicate a short to ground with these field windings.

Diodes. Six diodes are mounted on the exciter rotor; they rectify the AC voltage produced by the three groups of auxiliary windings to DC voltages and supply this DC voltage to the rotating field windings.

RESISTANCE VALUE

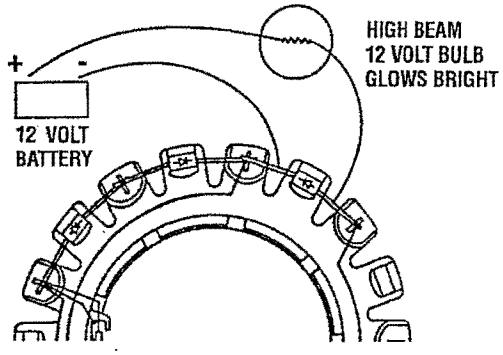


The diodes can be easily checked in place with the use of a common automotive 12-volt high beam headlight bulb, some jumper leads and the generator's 12 volt starting battery.

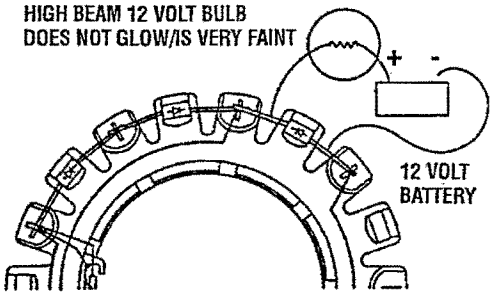
A short or an open in a diode can easily be found with the above without having to unsolder and isolate each diode to check it with an ohmmeter.

NOTE: *Attempting to check diodes in place with an ohmmeter will give erroneous readings on the diodes due to the auxiliary winding's connections.*

When leads are put across the diode, as illustrated, voltage passes through the diode allowing the headlight to glow brightly.



Reverse the leads across the diode. The diode should block voltage passing through it, and the headlight should not glow, or it may glow faintly.



a. Should the bulb not glow with leads connected in both directions, the diode is open internally.

b. Should the bulb glow with leads connected in both directions, the diode is shorted internally.

In both **a** and **b** above, the diode should be replaced. Check the resistance values of the rotating field windings and the integrity of the resistors connected between the field windings.

Rotating Field Windings 7.0–8.0 ohm. (Reading taken between the two red & white wires connected to the (+) and (–) terminals of the exciter rotor as shown in the illustration.)

Posi-resistor. (Infinite readings between both yellow leads lifted from the (+) and (–) terminals on the exciter rotor.) A shorted posi-resistor will destroy the rotating field and cause the AC output voltage to drop to zero.

MEASURING RESISTANCE

Main Stator Windings

1. *Group #1.* The resistance value is measured between the lifted lead #4 from the insulated terminal below the transformer and lead #6 lifted from the AC terminal block. In order to totally isolate the stator windings of group #1, lead #5 should be lifted from the terminal block.
2. *Group #2.* The resistance value is measured between the lifted lead #1 from the insulated terminal below the transformer and lead #3 lifted from the AC terminal block. In order to totally isolate the stator windings of group #2, lead #2 should be lifted from the terminal block.
   Main Stator Windings 20 - 22 Ohms
3. *Main Stator Auxiliary Windings* are measured between the double leads on the AC terminal of the bridge rectifier, unplugged from the rectifier and the double lead central prong connection of the regulator plug.
   Main Stator Auxiliary Windings 1.5 - 1.8 Ohms

NOTE: *No continuity should be found between either of these winding groups or to the generator case.*

Compound Transformer

Group 1 measured between Lead #10 at the AC terminal block and Lead #4 at the junction box. Lift both leads along with lead #9 at the terminal block.

Group 2 measured between Lead #8 at the AC terminal block and Lead #4 at the junction block. Lift both leads along with lead #7 at the terminal block.

Compound Transformer Windings 0.019 - 0.021 Ohms

A three connection voltage connection terminal was added to this circuit located just below the AC terminal block at the lower left. Isolate the three numbered #1, #2, and #3 red and white-striped wires coming onto each of the three terminals. Lift the black and white-striped leads and the green and white-striped leads off of their connections on the AC terminal block. Measure the resistance value between the #1 red lead lifted from the terminal strip and the black and white striped lead lifted from the AC terminal block.

Transformer Auxiliary Windings 4.0 - 4.5 Ohms

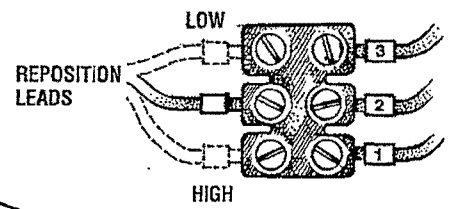
VOLTAGE CONNECTION TERMINAL

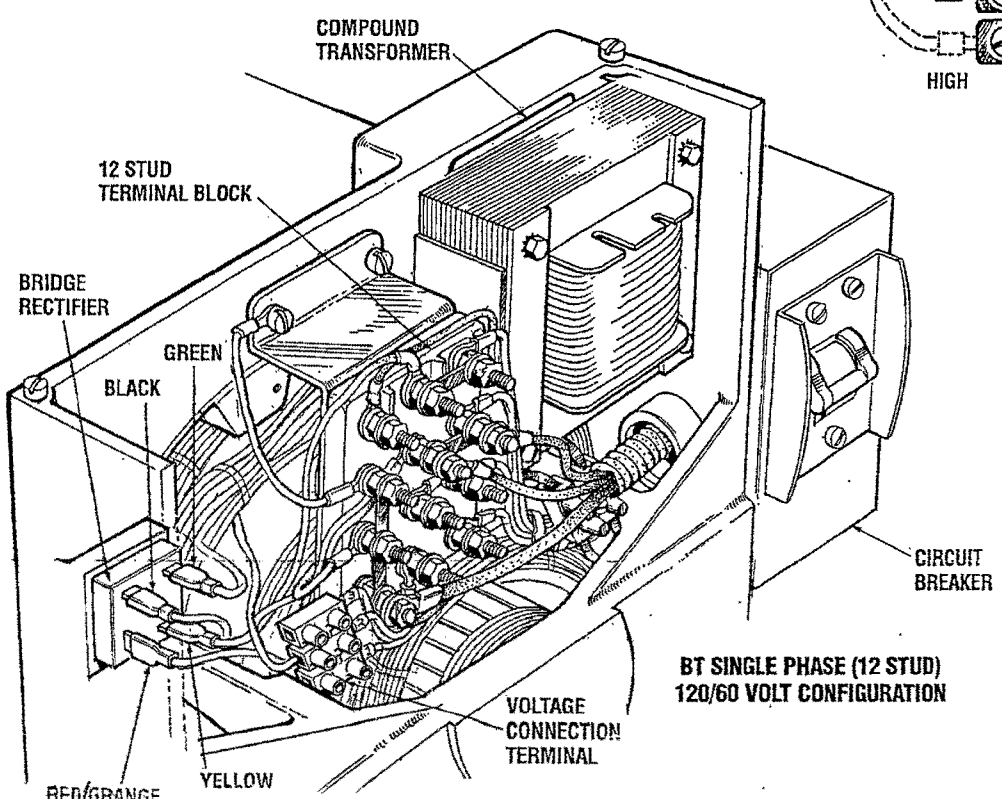
The addition of the three connection terminal is for the increase or decrease of full-load voltage output. Should full-load voltage fall below 108 volts, selecting a higher number terminal strip lead to connect the lead (red or red and white) will supply a higher AC voltage to the exciter circuit during full-load conditions, bringing the output voltage of the generator up.

No-load voltage should be properly adjusted by shimming the compound transformer: 121 - 124 volts at 60.0 – 60.5 hertz. The above should not be used as a means of compensating for incorrectly adjusting the generator's no-load voltage.

NOTE: *For engine speed/hertz adjustment, see ENGINE ADJUSTMENTS in this manual.*

VOLTAGE CONNECTION TERMINAL





BT SINGLE PHASE (12 STUD) 120/60 VOLT CONFIGURATION

LAY-UP AND RECOMMISSIONING

GENERAL

Many owners rely on their boatyards to prepare their craft, including engines and generators, for lay-up during the off-season or for long periods of inactivity. Others prefer to accomplish lay-up preparation themselves.

The procedures which follow will allow you to perform your own lay-up and recommissioning, or you may use them as a check list if others do the procedures.

These procedures should afford your engine protection during a lay-up and also help familiarize you with the maintenance needs of your engine.

If you have any questions regarding lay-up procedures, call your local servicing dealer; he will be more than willing to provide assistance.

PROPELLER SHAFT COUPLING

The transmission and propeller half couplings should always be opened up and the bolts removed when the boat is hauled out of the water or moved from land to water, and during storage in the cradle. The flexibility of the boat often puts a severe strain on the propeller shaft or coupling or both, while the boat is taken out or put in the water. In some cases, the shaft has actually been bent by these strains. This does not apply to small boats that are hauled out of the water when not in use, unless they have been dry for a considerable period of time.

FRESH WATER COOLING CIRCUIT

A 50-50 solution of antifreeze and distilled water is recommended for use in the coolant system at all times. This solution may require a higher concentration of antifreeze, depending on the area's winter climate. Check the solution to make sure the antifreeze protection is adequate.

Should more antifreeze be needed, drain an appropriate amount from the engine block and add a more concentrated mixture. Operate the engine to ensure a complete circulation and mixture of the antifreeze concentration throughout the cooling system. Now recheck the antifreeze solution's strength.

LUBRICATION SYSTEM

With the engine warm, drain all the lubricating oil from the oil sump. Remove and replace the oil filter. (Place some paper towels and a plastic bag around the filter to catch the oil during its removal.)

When installing the new oil filter, be sure to apply a small amount of oil on the rubber sealing gasket at the base of the filter. Fill the sump with the correct amount of oil for your engine. (Refer to the *SPECIFICATIONS* section of this manual.) Use an oil with an API specification of CF or CG-4. Run the engine and check for proper oil pressure and make sure there are no leaks.

> ⚠ **CAUTION:** ***Do not leave the engine's old lubricating oil in the sump over the lay-up period. Lubricating oil and combustion deposits combine to produce harmful chemicals which can reduce the life of your engine's internal parts.***

FUEL SYSTEM

Top off your fuel tanks with No. 2 diesel fuel. Fuel additives such as *BioBor* and *Sta-Bil* should be added at this time to control algae and condition the fuel. Care should be taken that the additives used are compatible with the primary fuel filter/water separator used in the system. Change the element in your primary fuel filter/water separator, if the fuel system has one, and clean the separator sediment bowl.

Change the fuel filter elements on the engine and bleed the fuel system, as needed. Start the engine and allow it to run for 5 – 10 minutes to make sure no air is left in the fuel system. Check for any leaks that may have been created in the fuel system during this servicing, correcting them as needed. Operating the engine for 5 – 10 minutes will help allow movement of the treated fuel through the injection equipment on the engine.

RAW WATER COOLING CIRCUIT

Close the through-hull seacock. Remove the raw water intake hose from the seacock. Place the end of this hose into a five gallon bucket of clean fresh water. Before starting the engine, check the zinc anode found in the primary heat exchanger on the engine and clean or replace it as required, and also clean any zinc debris from inside the heat exchanger where the zinc anode is located. Clean the raw water strainer.

Start the engine and allow the raw water pump to draw fresh water through the system. When the bucket is empty, stop the engine and refill the bucket with an environmentally friendly antifreeze solution slightly stronger than needed for winter freeze protection in your area.

Start the engine and allow all of this mixture to be drawn through the raw water system. Once the bucket is empty, stop the engine. This antifreeze mixture should protect the raw water circuit from freezing during the winter lay-up, as well as providing corrosion protection.

Remove the impeller from your raw water pump (some antifreeze mixture will accompany it, so catch it in a bucket). Examine the impeller. Acquire a replacement, if needed, and a cover gasket. Do not replace the impeller (into the pump) until recommissioning, but replace the cover and gasket.

INTAKE MANIFOLD AND THROUGH-HULL EXHAUST

Place a clean cloth, lightly soaked in lubricating oil, in the opening of the intake manifold to block the opening. Do not shove the cloth out of sight. (If it is not visible at recommissioning, and an attempt is made to start the engine, you may need the assistance of a servicing dealer.) Make a note to remove the cloth prior to start-up. The through-hull exhaust port can be blocked in the same manner.

LAY-UP & RECOMMISSIONING

Starter Motor

Lubrication and cleaning of the starter drive pinion is advisable, if access to the starter permits its easy removal. Make sure the battery connections are shut off before attempting to remove the starter. Take care in properly replacing any electrical connections removed from the starter.

Cylinder Lubrication

If you anticipate a long lay-up period (12 months or more) WESTERBEKE recommends removing the glow plugs or fuel injectors for access to the cylinders. Squirting light lubricating oil into the cylinders to prevent the piston rings from sticking to the cylinder walls. Rotate the engine by hand two revolutions then replace the glow plugs or injectors.

Make sure you have a replacement if removing the injector sealing washer for the injector and fuel return line.

Intake Manifold *[Gasoline]*

Clean the filter screen in the flame arrester, and place a clean cloth lightly soaked in lube oil around the flame arrester to block any opening. Also place an oil-soaked cloth in the through-hull exhaust port. Make a note to remove cloths prior to start-up!.

Intake Manifold and Thru-Hull Exhaust *[Diesel]*

Place a clean cloth, lightly soaked in lubricating oil, in the opening of the intake manifold to block the opening. Do not shove the cloth out of sight. (If it is not visible at recommissioning, and an attempt is made to start the engine, you may need the assistance of a servicing dealer.) Make a note to remove the cloth prior to start-up. The through-hull exhaust port can be blocked in the same manner.

BATTERIES

If batteries are to be left on board during the lay-up period, make sure they are fully charged, and will remain that way, to prevent them from freezing. If there exists any doubt that the batteries will not remain fully charged, or that they will be subjected to severe environmental conditions, remove the batteries and store them in a warmer, more compatible environment.

> ⚠ **Warning:** ***Lead acid batteries emit hydrogen, a highly-explosive gas, which can be ignited by electrical arcing or a lighted cigarette, cigar, or pipe. Do not smoke or allow an open flame near the battery being serviced. Shut off all electrical equipment in the vicinity to prevent electrical arcing during servicing.***

Transmission *[Propulsion Engine]*

Check or change the fluid in the transmission as required. Wipe off grime and grease and touch up any unpainted areas. Protect the coupling and the output flange with an anti-corrosion coating. Check that the transmission vent is open. For additional information, refer to the *TRANSMISSION SECTION.*

Spare Parts

Lay-up time provides a good opportunity to inspect your WESTERBEKE engine to see if external items such as drive belts or coolant hoses need replacement. Check your basic spares kit and order items not on hand, or replace those items used during the lay-up, such as filters and zinc anodes. Refer to *SPARE PARTS* section of this manual.

Recommissioning

The recommissioning of your WESTERBEKE engine after a seasonal lay-up generally follows the same procedures as those presented in the *PREPARATIONS FOR STARTING* section regarding preparation for starting and normal starts. However, some of the lay-up procedures will need to be counteracted before starting the engine.

1. Remove the oil-soaked cloths from the intake manifold
2. Remove the raw water pump cover and gasket. and discard the old gasket. Install the raw water pump impeller removed during lay-up (or a replacement, if required). Install the raw water pump cover with a new cover gasket.
3. Reinstall the batteries that were removed during the lay-up, and reconnect the battery cables, making sure the terminals are clean and that the connections are tight. Check to make sure that the batteries are fully charged.

> ⚠ **CAUTION:** ***Wear rubber gloves, a rubber apron, and eye protection when servicing batteries. Lead acid batteries emit hydrogen, a highly explosive gas, which can be ignited by electrical arcing or a lighted cigarette, cigar, or pipe. Do not smoke or allow an open flame near the battery being serviced. Shut off all electrical equipment in the vicinity to prevent electrical arcing during servicing.***

4. Remove the spark plugs, wipe clean, re-gap, and install to proper tightness [*gasoline*].
5. Check the condition of the zinc anode in the raw water circuit and clean or replace the anode as needed. Note that it is not necessary to flush the antifreeze/fresh water solution from the raw water coolant system. When the engine is put into operation, the system will self-flush in a short period of time with no adverse affects. It is advisable, as either an end of season or recommissioning service, to inspect the area where the zinc is located in the heat exchanger and clear any and all zinc debris from that area.
6. Start the engine in accordance with procedures described in the *PREPARATIONS FOR INITIAL START-UP* section of this manual.

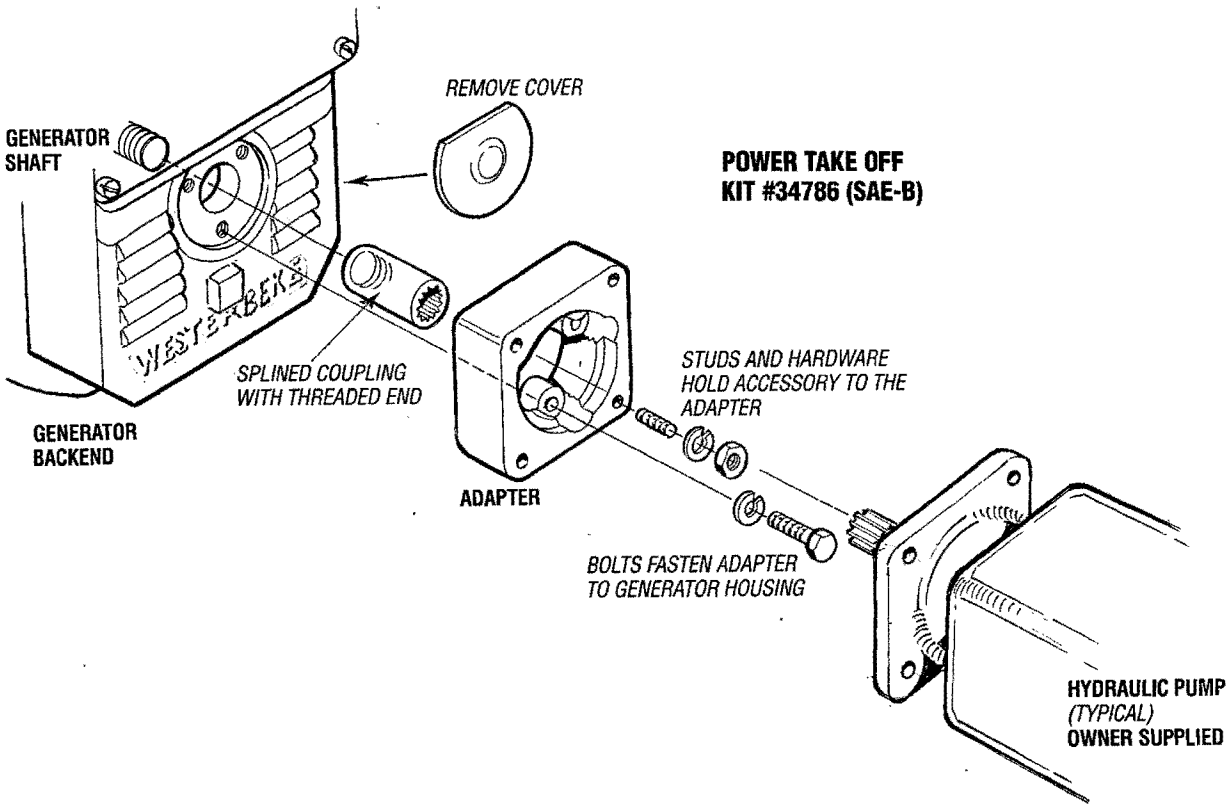
POWER TAKE OFF SYSTEMS

POWER TAKE OFF ADAPTER

A power take off adapter can be attached to the generator backend. This adapter allows access to the full power of the engine for a variety of hydraulic and electrical accessories.

The 7.6Kw ETD produces 11hp at a continuous 1800 rpm (8hp at 50Hz 1500 rpm). This horsepower can be utilized either for generator AC output or to operate the power take off.

Contact your WESTERBEKE DISTRIBUTOR for additional information.


REMOVE COVER
GENERATOR SHAFT
POWER TAKE OFF KIT #34786 (SAE-B)
SPLINED COUPLING WITH THREADED END
STUDS AND HARDWARE HOLD ACCESSORY TO THE ADAPTER
GENERATOR BACKEND
ADAPTER
BOLTS FASTEN ADAPTER TO GENERATOR HOUSING
HYDRAULIC PUMP (TYPICAL) OWNER SUPPLIED

STANDARD AND METRIC CONVERSION DATA

LENGTH-DISTANCE

Inches (in) x 25.4 = Millimeters (mm) x .0394 = Inches
Feet (ft) x .305 = Meters (m) x 3.281 = Feet
Miles x 1.609 = Kilometers (km) x .0621 = Miles

DISTANCE EQUIVALENTS

1 Degree of Latitude = 60 Nm = 111.120 km
1 Minute of Latitude = 1 Nm = 1.852 km

VOLUME

Cubic Inches (in^3) x 16.387 = Cubic Centimeters x .061 = in^3
Imperial Pints (IMP pt) x .568 = Liters (L) x 1.76 = IMP pt
Imperial Quarts (IMP qt) x 1.137 = Liters (L) x.88 = IMP qt
Imperial Gallons (IMP gal) x 4.546 = Liters (L) x .22 = IMP gal
Imperial Quarts (IMP qt) x 1.201 = US Quarts (US qt) x .833 = IMP qt
Imperial Gallons (IMP gal) x 1.201 = US Gallons (US gal) x .833 = IMP gal
Fluid Ounces x 29.573 = Milliliters x .034 = Ounces
US Pints (US pt) x .473 = Liters(L) x 2.113 = Pints
US Quarts (US qt) x .946 = Liters (L) x 1.057 = Quarts
US Gallons (US gal) x 3.785 = Liters (L) x .264 = Gallons

MASS-WEIGHT

Ounces (oz) x 28.35 = Grams (g) x .035 = Ounces
Pounds (lb) x .454 = Kilograms (kg) x 2.205 = Pounds

PRESSURE

Pounds Per Sq In (psi) x 6.895 = Kilopascals (kPa) x .145 = psi
Inches of Mercury (Hg) x .4912 = psi x 2.036 = Hg
Inches of Mercury (Hg) x 3.377 = Kilopascals (kPa) x .2961 = Hg
Inches of Water (H_2O) x .07355 = Inches of Mercury x 13.783 = H_2O
Inches of Water (H_2O) x .03613 = psi x 27.684 = H_2O
Inches of Water (H_2O) x .248 = Kilopascals (kPa) x 4.026 = H_2O

TORQUE

Pounds-Force Inches (in-lb) x .113 = Newton Meters (Nm) x 8.85 =in-lb
Pounds-Force Feet (ft-lb) x 1.356 = Newton Meters (Nm) x .738 = ft-lb

VELOCITY

Miles Per Hour (MPH) x 1.609 = Kilometers Per Hour (KPH) x .621 = MPH

POWER

Horsepower (Hp) x .745 = Kilowatts (Kw) x 1.34 = MPH

FUEL CONSUMPTION

Miles Per Hour IMP (MPG) x .354 = Kilometers Per Liter (Km/L)
Kilometers Per Liter (Km/L) x 2.352 = IMP MPG
Miles Per Gallons US (MPG) x .425 = Kilometers Per Liter (Km/L)
Kilometers Per Liter (Km/L) x 2.352 = US MPG

TEMPERATURE

Degree Fahrenheit (°F) = (°C X 1.8) + 32
Degree Celsius (°C) = (°F - 32) x .56

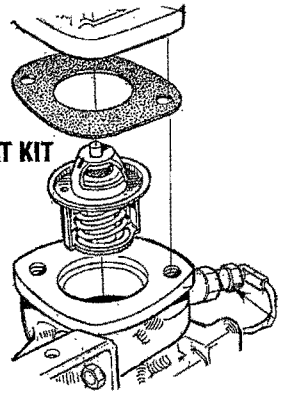
LIQUID WEIGHTS

Diesel Oil = 1 US gallon = 7.13 lbs
Fresh Water = 1 US gallon = 8.33 lbs
Gasoline = 1 US gallon = 6.1 lbs
Salt Water = 1 US gallon = 8.56 lbs

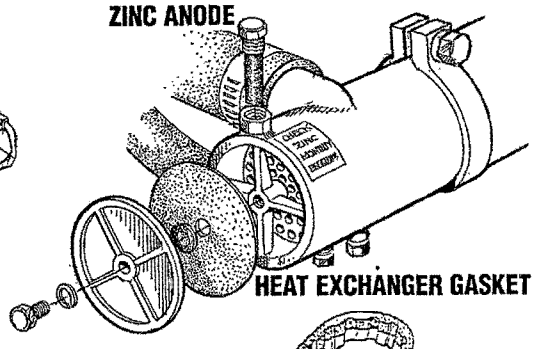
SUGGESTED SPARE PARTS

CONTACT YOUR WESTERBEKE DEALER FOR SUGGESTIONS AND ADDITIONAL INFORMATION

WESTERBEKE RECOMMENDS CARRYING ENOUGH ENGINE OIL (YOUR BRAND) FOR AN OIL CHANGE AND A GALLON OF PREMIXED COOLANT.

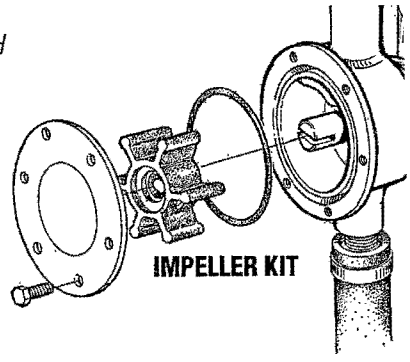


THERMOSTAT KIT

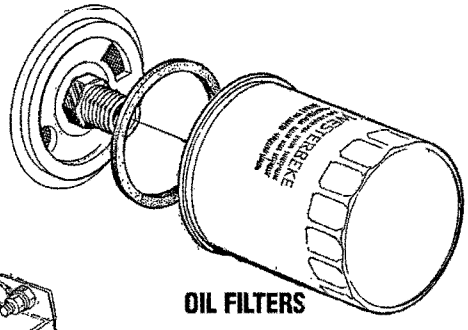


ZINC ANODE

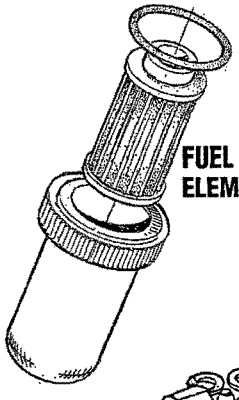
HEAT EXCHANGER GASKET



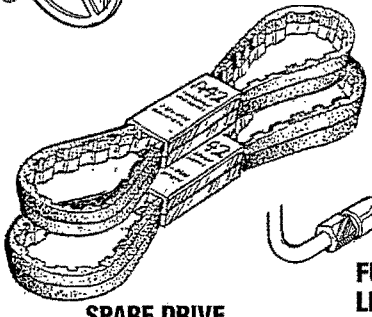
IMPELLER KIT



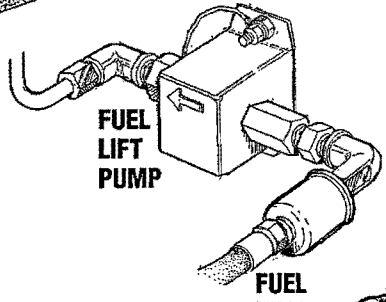
OIL FILTERS



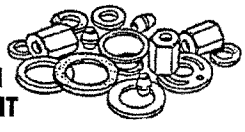
FUEL FILTER ELEMENT



SPARE DRIVE BELTS

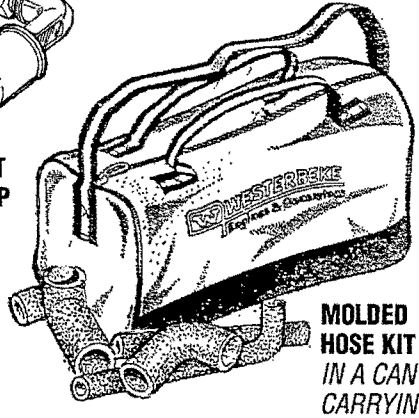


FUEL LIFT PUMP

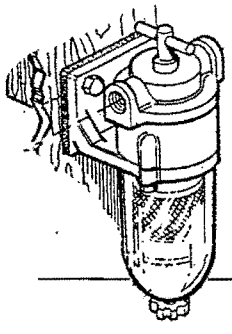


FUEL SYSTEM HARDWARE KIT

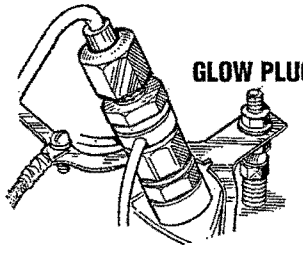
FUEL INLET PUMP



MOLDED HOSE KIT *IN A CANVAS CARRYING BAG*



IN-LINE FUEL/WATER FILTER CARTRIDGE



GLOW PLUG

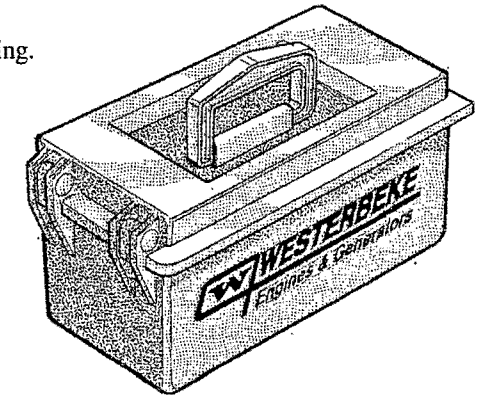
INJECTOR

SPARE PARTS KITS

WESTERBEKE also offers two Spare Parts Kits, each packaged in a rugged hinged toolbox.
Kit "A" includes the basic spares.
Kit "B" is for more extensive off-shore cruising.

KIT A

ZINC ANODES
DRIVE BELTS
OIL FILTER
FUEL FILTER
HEAT EXCHANGER GASKET
IMPELLER KIT
FUEL SYSTEM HARDWARE KIT
FUEL PUMP INLET FILTER



KIT B

ZINC ANODES
DRIVE BELTS
OIL FILTER
FUEL FILTER
HEAT EXCHANGER GASKET
IMPELLER KIT
INJECTOR
OVERHAUL GASKET KIT
GLOW PLUG
FUEL SYSTEM HARDWARE KIT
FUEL PUMP INLET FILTER

WESTERBEKE
Engines & Generators

WESTERBEKE
Engines & Generators